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Title	A Study on the Tenants' Usage and the Design Guidelines for Public Housing in China
Author(s)	李, 翥彬
Degree Grantor	北海道大学
Degree Name	博士(工学)
Dissertation Number	甲第11458号
Issue Date	2014-03-25
DOI	https://doi.org/10.14943/doctoral.k11458
Doc URL	https://hdl.handle.net/2115/55585
Type	doctoral thesis
File Information	Li_Zhubin.pdf





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A Study on the Tenants' Usage and the Design Guidelines for Public Housing in China

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February 2014, Sapporo

Abstract

After the housing policy reform of 1998, a new housing system was established in China which consisted of two housing types, the affordable housing and the low-rent housing. However, the public housing provision has been insufficient for a long time. Great attention is therefore taken on both perfecting the public housing system and planning. The researches on public house planning and design are totally insufficient, which are based on the actual needs and demands of inhabitants. This study focuses on the satisfaction level between design and residents' demands of the current public housing of their room usage, and aims to develop a guideline for future public housing design. Special requirements for the elderly and disabled were also considered, whereby, and as universal design concept is getting important on issues of public housing in China. All data used in this research was obtained from original surveys on six public housing projects in Shenyang.

This thesis consists of seven chapters.

Chapter 1 gives a general introduction about the background, questions and purpose of this study. Through critical reviews on related literatures, notably studies on public housing satisfaction in China are insufficient and lack considerations on the residents' actual wishes. In addition, the elderly and the disabled are excluded from the target users. As a result, living environment in public housing is not accessible and usable for such tenants and which calls for prompt improvements.

Chapter 2 introduces China's housing reform and the three public housing types, under a new system. The Japanese public housing system and the new development strategy are considered for comparison. In here, the Chinese government devotes to eliminate the shortage of public housing provision, whereby, the Japanese government pays more attention on improving the quality of the living environment. Predictions say that trend what Japanese public housing is experiencing, would also happen in China. Such forecast is of critical importance for Chinese public housing provision.

Chapter 3 explores the residents' satisfaction on housing unit and building features. The data used for analyses was based on two interview surveys, carried out

in 2011 and 2012. The response from the elderly and the disabled show that their condition of housing unit is worse than the general respondents'. Units and parameters like the (1) living room, (2) floor plan and (3) the housing area were assessed and were bad. To achieve a more satisfactory living environment, these three parameters must be taken into account.

Chapter 4 reviews the residents' room usage in public housing. Through analyzing the collected data, issues concerning housing unit and planning were pointed out. The floor plans were classified into five groups according to the room usage in each housing unit, with their general features and special characteristics in detail. In general, the residents consider the living room as more important than the other interior units. Family composition greatly affects the usage of the living room. An obvious feature is that the living room would be used as a bedroom as expected in most of the extended families. Moreover, some uncommon usage could also be found in the bedroom, bathroom and kitchen. Thus, the various lifestyles and family compositions must be carefully considered in the future public housing design.

Chapter 5 analyzes the usage of the living room which is regarded as the major space based on preceding research. The living room styles were concluded as "Living room Kitchen style (LK style)", "Living room and Kitchen style (L&K style)" and "The others". Then, the feature usage of each living room and style is discussed individually. The results indicate a wider living room with a regular shape could satisfy more residents. Given the residents' diverse lifestyles and family compositions, spatial adaptability in living room must be taken into account in future planning.

Chapter 6 develops a design guideline for Chinese public housing mainly based on the Universal design concept. This guideline focuses on the interior space and aims to achieve a universal environment by trying to eliminate the obstacles in each space to the greatest extent possible. Following the guideline, two model units are proposed to specify how these concepts could be transformed into the actual design. In the two models, the sizes of the kitchen and the bathroom are enlarged to satisfy the wheelchair users. Meanwhile, the visual access is also improved by making the kitchen semi-open. This enables the people in the kitchen to visual access to other

family members in the living room. Moreover, an adjustable inner wall is designed in each unit to provide flexibility to the interiors.

Chapter 7 summarizes this paper. Based on the preceding discussions, the major findings could be stated as follows:

a. This study firstly investigates the residents' satisfaction about the public housing unit features in China. The information is of crucial importance for policy making and building design. The results indicate that the living room has a strong impact on the residents' satisfaction and should be given more design priority. It also reveals some other key issues which need to be addressed in the future to instruct the guidelines and designers.

b. Using the floor plan data obtained from the surveys, the housing units are classified into different groups. The room usage in each group of housing unit is studied individually. In doing so, the demands of the residents for more usable interior space are vital and an integral part of this research. It becomes clear that both the household composition and the housing unit type will affect the room usage pattern where more responsive strategies are expected to be employed.

c. Based on the existing Chinese national codes, the universal design concepts as well as the findings of this study, a universal design guideline for public housing design is developed. This design guideline provides a set of strategies to improve the accessibility and usability of the housing unit. It could widely be used not only in Shenyang city but also in other Chinese cities as well, to help amend their own regulations or design guidelines.

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1 Introduction: Research Background, Purposes and Framework

1.1 Background Information on Chinese Public Housing

In the socialist China, housing system is greatly different from the majority of capitalist countries before a housing reform took place in 1998. The old housing system of China was developed according to a state-owned housing distribution system, in which the state takes responsibility of housing construction and distributes housing units to citizens as a kind of social welfare (Chen, et al., 2011). In other words, there was no private housing market in China at the time and all houses in this country could be called “Public housing” (developed and managed by governments) to a certain extent. After the opening-up policy implemented in 1978, housing market began to transform from a state-sponsored welfare housing provisioning system to a market-oriented housing provisioning system. The transformation experienced around two decades’ development and underwent several critical modifications in the middle of 1990s, and then a dual housing system was established in 1998. In this system, city housing market is divided

into two sectors, namely, commodity housing market and public housing sector. Housing in commodity housing market is constructed by private real estate developers and priced by market mechanism. They can be exchanged freely just like them in other countries. Public housing, including affordable housing and low-rent housing, is jointly developed by local government and private developers. The disadvantaged groups such as low-income families or the disabled can obtain housing unit through this system by pay an affordable rates or rent. The new system brought two outcomes. Commodity housing market developed extremely fast and become one of the most important industries in China. Meanwhile, commodity housing rates have far exceeded the affordability of common citizens. In contrast to thriving commodity housing market, public housing provision is inadequate in a long period of time mainly due to its limited contribution to financial revenue. Nevertheless, as the conflicts between the affordability of populations and commodity housing rates became sharper and sharper, the governments have to address the housing needs of citizens by promoting public housing construction. Thus, public housing policy is becoming an essential component of public policy in one city and attracting more and more concerns from policy makers and the public.

Concerning public housing design, Chinese scholars conducted limited studies in the past a decade. Debates revolved around how to refine the housing distribution system and improve the provision (Jia & Liu, 2007; Wen et al., 2013; Ge & Jia, 2011). Researchers from different fields studied the public housing policies in America, German, Japan, etc., and then pointed out the lessons which could be absorbed in the process of policy making in China (Huang, 2010; Sun & Lin, 2009; Lin & Zhou, 2008). However, studies on design, which are critical for improving the quality of life of public housing residents, were left out in a sense. In order to provide enough housing unit in a short period of time, design have to be

completed as soon as possible. Thus, architects have no time to carefully consider the detail in design. Additionally, knowledge about public housing design in China is still limited and cannot support design practice effectively. The previous studies concerning public housing design usually concluded with recommendations on design strategies, but the detailed guidelines were missed. Moreover, these design strategies are not mandatory, and are easily neglected in many cases. These lead to the inappropriate design in public housing, which may cause diverse inconveniences in residents' daily living and housing modification.

The ultimate purpose of public housing program should be securing the right of abode of disadvantaged groups, promoting social equality and improving the quality of life of all populations. Current initiatives of the central and local governments concentrated on perfecting policy system to ensure every eligible family can access to public housing and exclude the ones ineligible. Another central practice of Chinese governments is promoting public housing construction to alleviate the shortage of housing unit provision. These efforts are surely important to address the issues on public housing. At the same time, the physical environment should not be ignored and is equally important for the solutions to this issue. In a sense, it is more essential to public housing residents since it could be easily perceived and can directly affect the daily living of them, especially the housing unit floor plan and interior environment. This research focuses on the housing interiors and the interior environment aim to identify the actual needs of public housing residents in housing unit from a perspective of design architect. It is a supplement to present public housing construction and policy making, and will be beneficial to achieving an integrated solution to address the needs of residents in China.

1.2 Related Concepts and Practices on Public Housing Design

Public housing, also called as social housing or publicly assisted housing in some contexts, is a significant component of housing typology in one country. Generally speaking, public housing programs are aimed at provide housing for those citizens who cannot afford the commodity housing rates, including those with disabilities and the elderly. The issues in relation to public housing vary in different countries. The distribution system, funding resources and regulations for construction all could be involved. Concerning building design, the enormous concerns of researchers are centered on how to address the issues emerged from the interaction between human being and the built environment. Human centered design is a widely accepted concept. The advocates of this concept come from different fields suggest all design practices should involve the end user, incorporating the professional knowledge from social science of psychology, anthropology and sociology into the design process. That will be beneficial to achieve a comprehensive approach to improve the human performance in the varied built environments. Similar with the majority of states, Chinese public housing units generally occupies by those low-income people and families, including the disabled and the elderly. Their limited capacity for performing tasks in daily living well is one of their characteristics that would greatly affect the physical environment design. In order to meet their needs for a more livable housing, the following concepts were developed and discussed by many researchers.

1.2.1 Accessible housing

Accessible housing is the housing designed for the person with disability to enable them to living independently. Many countries developed accessible housing programs to facilitate the living of disabled, typically the elderly with disabilities. For instance, the

Set-side Apartment in United States is a noteworthy case in relation to improving accessibility in public housing (Steinfeld & Maisel, 2012). The U.S. Architectural Barriers Act (ABA), enacted in 1968, requires all the federally funded constructions should be accessible and 5 percent of the units in all new constructions to be accessible. Although, this policy is problematic according to some researchers, it provides the early insights into the solutions to improving the accessibility in public housing in United States. In Chinese context, barrier free design is more widely known than accessible design by the public. A national code, “Codes for Design on Accessibility of Urban Roads and Buildings (JGJ50-2001)”, is the only national code focus on the accessible issues in the urban settings. Besides this national code, some items with respect to detailed accessible design also are available in the national codes of “Design Code for Residential Buildings (GB 50096-1999)” and “Code for Design of Residential Building for The Aged (GB/T 50340-2003)”. Nevertheless, there are no exclusive design regulations for public housing accessibility, though there are many disabled and old residents living in it. The latest published research articles inclined to use barrier free design to refer to the design strategies for accessibility. The public accommodations were contracting concerns from many researchers (Lv & Ye, 2009; Zhang, 2012), while accessibility in public housing has seldom been a research topic in popularity. The related studies in China are still limited and totally inadequate.

1.2.2 Adaptable and flexible housing

According to Altas and Ozsoy (1997), the adaptability of a building refers to its attribute that the configuration of the interior space is adjustable to accommodate the changing needs of occupants in the physical environment. While the flexibility of a building is defined as how well the occupants can perform various tasks without physical alterations in a building. The two concepts are closely interrelated with each other and jointly affect the user

satisfaction for quality housing. In practice, adaptable housing concept was conceived in Sweden and aimed to promote the social integration for people with severe disabilities (Steinfeld & Maisel, 2012). Basically, the target population of this design concept was still the disabled at the initial phase. After the concept spread to other countries, the target group was widened greatly to address the needs of every occupant who was diverse in abilities. The open housing approach is an important means to achieve the adaptability and flexibility, and discussed by many researchers in recent years (Wong, 2010; Warouw et al., 2010; Dong, 2012; Chen, 2012). Open housing approach provides basic fixed structural walls for the occupants and enables them to decide the layout of the room by adding infill elements. The end users are involved in the design process, which is effective way of responding to the demands of adaptability and flexibility. Many countries incorporate the open housing approach in their residential building construction, such as Japan, Indonesia and Hong Kong. Typically, the open housing practice in Hong Kong where high-rise residential building is widely constructed is greatly referable to the housing design in mainland China where the detached housing construction has been prohibited.

1.2.3 Life span design

Many older Chinese prefer aging in place. A survey study indicated that 92.7% of older people in Huai'an city (a Chinese city in Jiangsu province) prefer aging in place, compared to aging in nursing apartment or agency (Zhao, 2012). In western context, aging in place is also the most desirable means to aging. It not only benefits the people over the age of 50, but also the all age groups. Since the design for aging in place takes the needs of occupants in different period of life into account, it will also facilitate the living of children and younger people. Aging in place require the housing to have more features than adaptable housing. But, these features are insufficient in many cases. In order to fill the gap, early attempt

to codify the design features is made by the United Kingdom, which known as Lifetime Homes (LTH) program. Design for those with mobility impairment was the central concern of LTH. The New Zealand and Australia developed a more inclusive approach through two programs, the Lifemark Initiative and Livable Housing Design. In the two programs, more age-related limitations in vision and hearing are taken into consideration. After review the previous literatures on this issue, Steinfeld and White (2010) concluded how to design a house for a life span in their book, *Inclusive Housing: A Pattern Book*. In Chinese literatures, design for a life span is known by many researchers, but there is no national code to regulate the design practice on this topic. Accordingly, design practice generally neglects it and just focuses on the immediate needs of the clients. This is an important reason for home modification in China.

1.2.4 Universal design

The emergence of universal design concept is closely related with accessible design and barrier free design concept. The pioneers of this new concept realized the current norms to facilitate the activities of people with disabilities is insufficient, and cannot completely eliminate the discrimination against the disabled. Thus, a new design concept is developed and discussed by many researchers, in which the target groups of design is defined as the all, not just a specific group of people. This new concept was termed “Universal Design (UD)”. In different contexts, universal design is also called as “design for all” (in Europe) or “inclusive design” (in UK), which has similar property. The most common definition of universal design is:

The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

--Mace (1985)

Some experts questioned this definition was vague in some points. First is some words could not be clearly understood in practice settings, such as “all people”, “greatest extent possible”. And moreover, the definition is ideal and unrealistic if we take it literally. Although it has these problems, universal design is being accepted by more and more people. After a careful review of the current critiques, Steinfeld and Maisel (2012) proposed an improved definition of universal design, which is:

Universal design is a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation.

The former definition of universal design is more like an idealistic goal of design, while the later one describes it as a continuous improvement toward full inclusion which is more realistic. Also, in the later definition, the approaches to universal design are specified, that is *by improving human performance, health and wellness and social participation*. In addition, the “all people” was replaced by the “diverse population” in the later definition. It did not put an absolute standard to design but view it as flexible range in different situations.

To effectively practice universal design, based on the previous practice in improving accessibility in dwelling unit, some intelligent people from different disciplines developed a tool for the practice of universal design, which known as “The Principles of Universal Design” (Connell et al., 1997; Story, 1998). This document clarified the scope of universal design and make universal design easier to implement. The followings are the seven principles defined in this document:

1. *Equitable use*. The design does not disadvantage or stigmatize any group of users.
2. *Flexibility in use*. The design accommodates a wide range of individual preferences and abilities.

3. *Simple and intuitive use*. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4. *Perceptible information*. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. *Tolerance for error*. The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. *Low physical effort*. The design can be used efficiently and comfortably, and with a minimum of fatigue.
7. *Size and space for approach and use*. Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility (Center for Universal Design, 1997; Connell et al., 1997).

Based on the seven principles, Steinfeld and Maisel (2012) presented eight goals of UD. They are:

1. *Body Fit*. Accommodating a wide a range of body sizes and abilities.
2. *Comfort*. Keeping demands within desirable limits of body function.
3. *Awareness*. Ensuring that critical information for use is easily perceived.
4. *Understanding*. Making methods of operation and use intuitive, clear, and unambiguous.
5. *Wellness*. Contributing to health promotion, avoidance of disease, and prevention of injury.
6. *Social integration*. Treating all groups with dignity and respect.
7. *Personalization*. Incorporating opportunities for choice and the expression of individual preferences.
8. *Cultural appropriateness*. Respecting and reinforcing cultural values and the social and environmental context of any design project.



Figure 1-1 Aeron Chair and Iphone. The Aeron chair is an office designed in 1994 by Don Chadwick and Bill Stumpf. The iphone is a complex device designed and produced by Apple Company. They are good examples of massively produced UD products.

Source: <http://www.hermanmiller.co.jp/Product/Aeron-Chairs;>

<http://www.telegraph.co.uk/technology/10267877/Apple-piloting-iPhone-trade-in-programme.html>

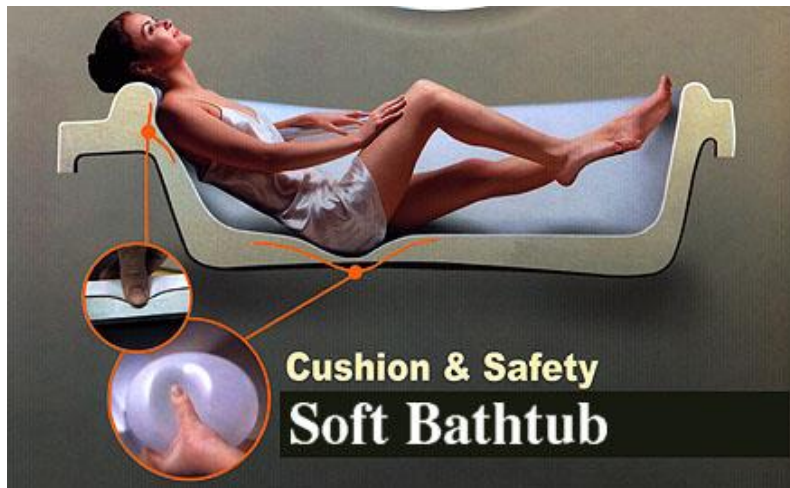


Figure 1-2 Soft Bathtub. The soft bathtub material was developed by International Cushion Products. It is considered having universal design features but not true universal design.

Source: Universal Design: Creating Inclusive Environments (2012); <http://www.hiwtc.com/photo/products/7/00/70/7017.jpg>

In order to spread and practice UD concept, some creative companies and groups designed many products, spaces and environments that are friendly to every potential user. Some of them have been massively produced, such as the Aeron Chair and iPhone (Figure 1-1). Some of them are still being discussed, such as the soft bathtub (Figure 1-2). Additionally, some public spaces also have UD features, even though they were not designed based on UD originally. City parks and roads with accessible facilities also make themselves friendlier to the wheel-chair users and other people with limited mobility. A good example comes from the City of New York, where an extensive initiative focused on improving

pedestrian and bicycle travel were developed. After the improvement, the street became safer and more attractive for pedestrian and biker. Thanks to new technologies advanced, UD is becoming more and more realistic for everyone. Automation, smart phone, video phone, wireless network, all these are changing our life. That is another reason why UD can attract the most concerns from designers, researchers and the public.

UD in China mainland seems not as popular as it is in western countries. UD related products and practices can be seldom found in the last few years. But in Taiwan, UD is being known and accepted by more and more people through an annual design competition. The Universal Design Award¹ started from 2006, organized by Foundation of Universal Design Education (FUDE), is to encourage college students and designers to consider how to improve our life by UD. It aims to create a freedom space to all by adopting UD concept in design. In Hong Kong, a book named “Universal Design Guidebook for Residential Development in Hong Kong²” was published in 2005 by Hong Kong Housing Society. This book is to guide the housing design practice in Hong Kong, where is one of the most demanding places in the world for which to design. The authorities wish the UD guidebook can help designers make design more accessible and safer. However, in mainland China, related studies and practices are still very limited. Zhang and Li (2009) discussed the difference between UD and Barrier-free Design, which had been discussed by many western researchers several years ago. Although researchers try to distinguish the two terms, there are still some researchers confused them. In his study on the traffic system in Shenzhen city, Sun (2012) tried to figure out the traffic issues in the city and achieve a barrier free traffic system based on UD concept. However, the most beneficiaries are still the disabled and elderly, which are specific groups of all populations. It doesn't align with the UD concept of design for all to a certain extent and should be refined. Studies on kitchen appliance design (Ma & Sun, 2013); housing

¹ See details at: <http://www.ud.org.tw/web/award/about.php>

² See details at: <http://www.hkhs.com/chi/info/udg.asp>

design for the elderly (Chen & Cheng, 2013) and the design of public building entry (Yue, 2013) were made in 2013. Nevertheless, the major outcomes of these studies are advices about design for products and spaces. Generally, these outcomes come from analyses on the previous design in countries where UD have been widely spread. On one hand, these are specific and detailed recommends on design and have not been put into a system that could guide design practices efficiently and effectively. On the other hand, design means differently in different contexts. There is a possibility that these experiences come from America or Europe may be incompatible with Chinese context. Thus, necessary revisions are required.

1.3 Research Questions and Purposes

The design concepts we discussed in the previous sections provide substantial valuable information about how to design a product or a house that could be usable for all. Based on these, we try to answer the following questions in this research:

a. Socio-geographic attributes: who are living in Chinese public housing?

In the official regulations on the management of public housing, Chinese local governments set up several restrictions on the application families, such as their monthly income and current unit space. Meanwhile, a priority is given to the elderly and disabled people when they apply for public housing. Thus, the composition of public housing residents is relatively complicated, compared to common residential community. To grasp their actual needs on housing unit, the first step should understand their socio-geographic attributes, which may affect their preferences greatly.

b. Room Usage: How do residents use their housing unit?

To understand the residents' preference on housing unit features, an effective way is observing their room usage. Observing can help

designer understand the preferred room usage of different household type and their needs on space. It is also an important way to find out the misses in current design which we should avoid in future.

c. Satisfaction: How do residents assess their housing unit?

Residential satisfaction is an important subjective indicator of success in housing. Satisfaction implies the users are content with the current situation and will stay here continuously. While dissatisfaction implies part of housing unit features cannot satisfy the occupants and may lead to move or housing modification. This information is a significant guide for many planners, designers and policy makers.

d. Experiences and lessons: Why and how to integrate UD into public housing construction?

Many countries, such as Japan and America, have studied different aspects of UD from different perspectives. They also put UD into practice many years ago and completed a few successful projects with UD concept. If we try to incorporate UD into Chinese public housing design and construction, their experiences and lessons on achieving UD would be valuable precedents, which China can refer to.

e. Solution: How to do the public housing design in the future?

Based on the answers of previous questions, I try to conclude this study with a specific and universal guideline for public housing design in China. This guideline focuses on the housing interiors, aims to help designers create accessible and usable housing units which all the occupants can benefit from in their daily life.

This study focuses on housing unit design, but not only on this. Chinese public housing system and some detailed regulations on public housing design at present also will be mentioned. It helps

scholars from different nations understand Chinese situation. Moreover, it is the basis of the following discussion on housing design. Part of the findings of this study is supposed to be meaningful and referable for policy makers when they enact new policies or revise the current regulations. In a word, the main purpose of this study is to explore the residents' room usage and satisfaction with their housing unit, then develop a guideline for housing unit design accordingly and provide several recommended revisions on current public housing policies.

1.4 Research Frame

According to the research questions and purposes I presented in the preceding section, the frame of this research could be organized in the way which is showed in Figure 1-3. The body of this research is composed of two discussions about residential satisfaction and room usage. Meanwhile, its implications for policy making and building design are also mentioned and explored in this research. Then, I try to introduce universal design concept into the design process and develop a design guideline for public housing. This guideline is expected to be a helpful reference for future public housing related policy making and building design.

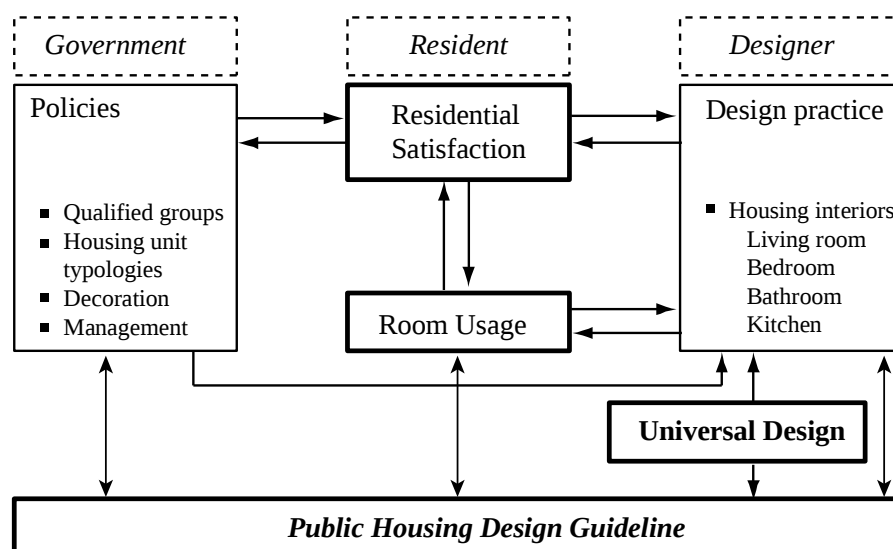


Figure 1-3 Research Frame

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2 Public Housing in China and Japan

2.1 Chinese Urban Housing Reform and Housing Provision System

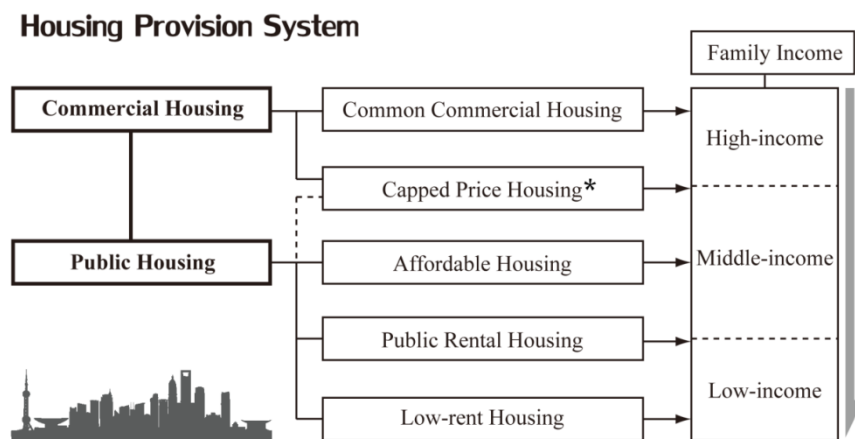
As we discussed in Chapter one, China experienced a transition from a welfare housing provision system to market-oriented housing provision system (Chen et al., 2010). In the process of transition, the unique land and housing tenure made it more complicated in the context of socialist China. Two important transitions should be mentioned when we discuss China's housing reform. They are the Reform and Opening-up Policy of 1978 and the abolishment of the old housing distribution system of 1998. Before 1978, China didn't have a real housing market. All the housing stocks were managed and maintained by the government and were freely provided for the citizens as a kind of social welfare. Tenants just needed to pay a nominal rent. However, the problem is managing a massive public housing stock was funded by government revenue which is an excessive financial burden for the government at that time (Deng et al., 2009). This is the original motivation behind the reform of urban housing policy. Meanwhile, the old housing distribution system also leads to a decline in per

capita living space, which is another important reason for housing reform. Within the pre-reform period, the per capita living space declined from 4.5 m² in the early 1950s to 3.6 m² in the late 1970s (Li, 1998). Additionally, work unit (Danwei)¹ is deeply involved in housing provision. Citizens affiliated to different work units were given different accesses to public resources, including housing provision. The inequality caused by this system also pushed the urban housing reform forward. Even after 1978, the influences from work unit on housing provision had not been eliminated entirely. Debate on the cession of state-owned land and work unit housing had been continuing for many years (Wu, 1996). The establishment of Housing Provident Fund (HPF)² scheme is another important point within the urban housing policy reform, which was firstly piloted in Shanghai from 1991 and extended to a nationwide level in 1995. Meanwhile, the welfare housing distribution system began to be abolished through a transition from welfare housing to private property. As the result of the transition, the percentage of housing investment from government and state-owned enterprises decreased from 80-90% to less than 50%. In 1998, the State Council issued “*A notification concerning further deepening urban housing reform and accelerating housing construction*”, which was considered a milestone and a symbol of abolition of the old social housing distribution system. After 1998, the private rate of urban housing increased fast and a relatively complete public housing system was established. In 2001, the

¹ The term of work unit (*Danwei*) generally refers to all work organizations, mainly including three categories: a, government or party organizations (*Dangzheng Jiguan*); b, profit-making enterprises (*Qiyue Danwei*); c, non-profit institutions (*Shiye Danwei*). The houses allocated to the employees in one work unit were called Danwei housing. The rent and price of the Danwei housing are significantly affected by the working time of the employees and the rank of their official position.

² Housing Provident Fund is a significant component of China's supportive policy for citizens' housing accessibility. The sources of HPF come from employees' salary and employers with a similar amount. The workers are given the right to withdraw it after retirement or use it to purchase house in commercial housing market. See Yeung, S. C. W. & Howes, R. (2006) for a detailed discussion.

private rate of urban housing already reached to 80% in most provinces (The People's Bank of China, 2002). Affordable housing (*Jingji Shiyong Fang*) and low-rent housing (*Lianzu Fang*), as the major components of a new public housing system, were encouraged in order to meet the housing needs of middle and low income groups. In 2010, a new public housing type, public rental housing (*Gonggong Zulin Zhufang*), was firstly mentioned within the central government official document "A notification concerning facilitating a stable and healthy development of real estate market". Public rental housing aims to fill the gap of coverage between affordable housing and low-rent housing and mainly target the migrant in cities. Currently, the transition from a welfare housing provision system to a market-oriented housing provision system had been completed and a new public housing system (Figure 2-1) targets low-income families and migrant is being established and refined in China.



*Capped price housing refers to the housing developed by private housing developers. The maximum price of these houses is regulated by the government as a condition that the developers access to city lots at a relatively low price. It is categorized as public housing in part of Chinese literature at times. In this research, I categorize it as commercial housing since there is no housing unit size limit for it, which is a common feature for the other three public housing types.

Figure 2-1 Chinese housing provision system

2.2 Three Different Public Housing Types

2.2.1 *Hukou* system and its impact on public housing distribution

Hukou is a kind of official permission for one to work and live in a certain city or town, and directly pertaining to one's access to public resources, including education, welfare, pension, etc. After a new infant born, its parents must register the birth at related authorities to get the *hukou* of the birth location. The *hukou* system of China was initially set up in 1951 in cities and extended to rural areas in 1955. The original purpose of the system is to monitor the migration of populations, and it did not limit people's residential choice and migration. Nevertheless, as influxes of peasants into cities, the central government tried many measures to curb the tendency and relieve the burden on cities. Thus, many new functions were added to *hukou* systems to reinforce the control of state on not only population migration, but also public resources distribution. In general, *Hukou* could be classified into two types, "urban *hukou*" and "rural *hukou*"³. Different *hukou* types are associated with greatly different social welfare, and public resources, which is a major reason for social inequality (Liu, 2005). For instance, one of the most important conditions for citizens to access to public housing units is that if he/she has the *hukou* registration of the city or not. I will discuss the impact of *hukou* to one's accessibility to public housing units in detail in the following several paragraphs.

³ There are two different classifications concerning *hukou* registration. The first classification is the place of *hukou* registration, based on a person's presumed regular residence. According to the first classification, the *hukou* registration was classified into "urban *hukou*" and "rural *hukou*"; another classification divide the *hukou* registration into "agricultural *hukou*" and "non-agricultural *hukou*", according to a person's entitlements to state-subsidized food grain (called "commodity grain"). Due to the two classifications are based on different criteria, it is possible that a person with non-agricultural *hukou* resides in the city areas and vice versa. In most literature, the populations are simply lumped together as "rural" and "urban". See Chan, K. W. & Zhang, L. (1999) for more information.

2.2.2 Affordable Housing (*Jingji Shiyong Fang*)

Affordable housing which has the attribute of indemnification refers to a particular group of commercial housing that jointly developed by private real estate developers or public work units and local government, targets the low-income families in cities. Exactly speaking, the target group of the affordable housing is those families which have urban *hukou* but have low affordability for commodity housing. Meanwhile, their income and housing conditions must meet the requirements developed by the local governments. It also is called as “economical and adaptable housing” (Wang, 2001), or “economic housing” (Ma, 2009) in some literatures. In this thesis, I employ the term of affordable housing which is more widely used by scholars (Hui & Wang, 2006; Yeung & Howes, 2006). Two features of affordable housing are worthy to be indicated, namely, affordability and adaptability. Affordability means the affordable housing have relatively low rate, compared to common commodity housing unit. Usually, the rate of an affordable housing unit is equivalent to 50% to 80% of commodity housing unit rate. Adaptability conveys the requirements of governments on housing design, unit area and construction standards. Almost all Chinese cities have their own regulations on these aspects.

The emergence of affordable housing happened in the early 1990s. Affordable housing system has experienced several reforms in many cities to avoid the flaws of the original policies. These flaws could be classified into the following categories:

- a. Family income information is hard to be obtained and verified.

It is difficult for governments to obtain the exact information of one's family income owing to the imperfect individual fund management and credit management in China. Especially concerning those people working in private companies, they usually have hidden income which is very difficult to make it clear.

In some local cities, verifying the qualification of applicants didn't attract enough concerns from the related authorities. This also leads to inequality in access to affordable housing, which is still a serious issue in some cities nowadays. Although the central and local government formulated many regulations to address these issues, the result is not satisfactory and still need to be refined according to new problems.

b. Affordable housing construction has not attracted adequate attentions from local governments and is developing slowly.

Part of local governments overly relies on the housing market to solve the housing needs of low-income families. Meanwhile, local cities did benefit from the development of housing market. Thus, some local governments are reluctant to affordable housing construction while focus on more beneficial commodity housing market development. As a result, affordable housing projects usually were arranged at the edge area of the city, where the land values are far cheaper than downtown area but far from city amenities.

c. Inadaptability in current affordable housing projects.

In order to reduce the construction cost of affordable housing projects, private developers usually choose relatively cheap architectural materials. Additionally, to provide more housing units in a certain city lot, architects are required to design some awkward units which have bad natural lighting or floor plan. This causes a potential for further modification, which will increase residents' living expenses and is given up in many cases. Moreover, some affordable housing projects located where far from medical, educational facilities leads to many inconveniences in residents' daily life. Building design and plan ignored the actual needs of residents and just take cost cut as the primary purpose.

d. Seriously inadequate provision

Because the target group is vaguely fixed, and the state did not stipulate the proportion of affordable housing in the whole housing market, the appropriate affordable housing provision could not be determined easily. According to original policies, affordable housing provision must account for 70% to 80% of total housing provision. However, the reality is the percentage of investment in affordable housing construction is continuously decreasing from 2000 (Table 2-1 & Figure 2-1). As a result, the provision of affordable housing totally cannot satisfy the housing needs of low-income families. The gap between housing supply and demand is becoming wider and wider.

Table 2-1 Investment in commodity housing and affordable housing in China

Year	Commodity Housing (Unit: billion RMB)	Affordable Housing (Unit: billion RMB)	Percentage of investment in Affordable housing (%)
1997	153.938	18.55	12
1998	208.156	27.085	13
1999	263.848	43.702	17
2000	331.198	54.244	16
2001	421.668	59.965	14
2002	522.776	58.905	11
2003	677.669	62.198	9
2004	883.695	60.639	6.8
2005	1086.093	51.918	4.8
2006	1363.841	69.684	5.1

e. Potential risk of subprime mortgage crisis

The target group of affordable housing policy is those low-income families. To them, buying a house is a very vast expense for them, even though the rate of affordable housing is far lower than it of commodity housing. Meanwhile, the eligible families could enjoy additional national supports on getting a loan from banks, such as a lower down payment or a longer loan payment period. However, they usually have the low ability to refund the loan, which is a kind of risk for granting commodity bank and an important reason for subprime mortgage crisis.

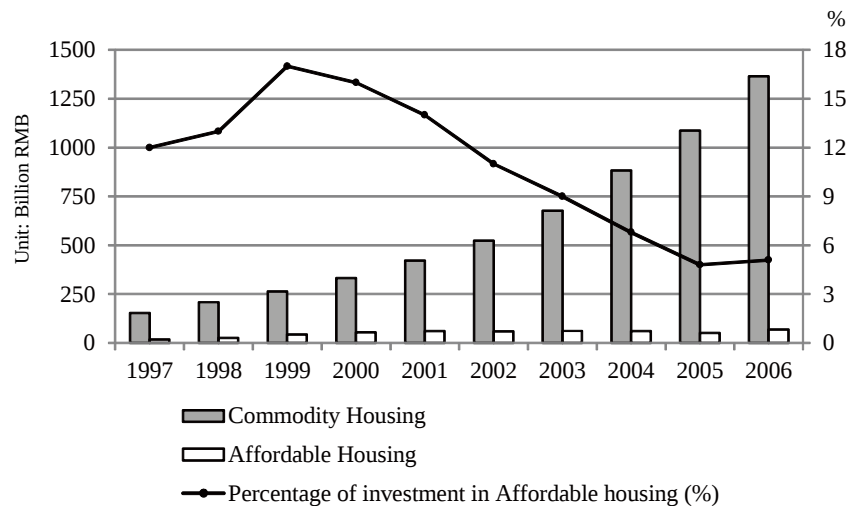


Figure 2-1 Decreasing tendency of percentage of investment in affordable housing

Although there are many problems arose in the past several years, affordable housing is still an integral component of current Chinese public housing provision system. How to revise and refine the current policies to deal with the new situation is always a hot topic for Chinese scholars and policy makers. For instance, some cities formulated their own affordable housing applying regulations to clarify a few vague terms or items in national regulations. As the income increasing, the qualified income level is also changing accordingly.

2.2.3 Public Rental Housing (*Gonggong Zulin Zhufang*)

The construction of affordable housing and low-rent housing improved the living condition of part of low-income families to a certain extent. Nevertheless, as we discussed at the beginning of this section, people's access to public housing unit is closely related to his *hukou* status. Generally, people who don't have urban *hukou* would not be given the right to apply for a public housing unit in a city, no matter affordable housing or low-rent housing. This causes a serious social issue that many migrants cannot apply for public housing unit, even though they have no place to live. Similar problems also perplex the newly college graduates. Most of them do not have enough savings to afford a commodity housing unit. At the same time, their relatively high income also

excludes them from public housing. In order to fill the coverage gap between affordable housing and low-rent housing, public rental housing is introduced to Chinese public housing system in 2009.

Public rental housing refers to the housing provided by governments or the agencies authorized by governments for low-income families and individuals with a market rent, meanwhile, governments subsidy the tenants monthly according to related official standards. Public rental housing belongs to governments and public organizations. Thanks to the subsidy from the government, tenants (mainly are migrants and new college graduates) could lease a public rental housing unit by an affordable rent. Generally, the rent of public rental housing will be more expensive than it of low-rent housing. Different cities charge different rent for living in public rental housing unit. For instance, the rent is equivalent to 80% of fair market rent at Beijing, while the percentage would be 70% to 80% at Qingdao and Nanjing.

Different from affordable housing and low-rent housing, public rental housing had not emerged in the public housing system after the China's housing reform. It has a relatively short history, but an extremely important status in Chinese future public housing system. The public rental housing will occupy a major portion of public housing provision in China, according to an official directive called "Directive concerning accelerating public rental housing construction" issued in June, 2010. Currently, just several cities completed a few pilot public rental housing projects. The available public rental housing unit is still very limited. In some cities, such as Shenyang, the regulations on public rental housing construction and allocation are still being formulated.

2.2.4 Low-rent Housing (*Lianzu Fang*)

Low-rent housing system is established after the China's housing reform in 1998. It is provided through two different approaches,

rental subsidy and real housing unit. Originally, the target group of low-rent housing is the lowest income families in city area. In 2007, the state council issued “Several suggestions on address the housing shortage for low-income families”, in which the target group of low-rent housing widened from “the lowest” to “low” income families. Until 2005, almost every province had implemented low-rent housing system in China except Tibet, including 221 local cities out of 291 cities. Until June, 2007, 89.3% of Chinese cities had developed the low-rent housing system. Currently, all Chinese cities had begun providing low-rent housing to low-income families, and low-rent housing provision has become one of the most important components of governments’ public service. Compared to real housing unit providing, rental subsidy is employed by many cities as the main approach to low-rent housing provision, due in part to its simple operation and direct effect on fulfilling the urgent housing needs of low-income families.

Compared to the other two public housing types in China, low-rent housing has three mentionable features. Firstly, even though the coverage group of low-rent housing policy had been widened, it still mainly focuses on the relatively lowest income families and individuals in city. It has the more attributes as a kind of social welfare. Secondly, the rent is nominal and extremely cheap. Different from affordable housing which is for sale, all low-rent housing units are planned to be rented by those lowest income families. Finally, the qualification of tenants will be verified periodically. Once they have not satisfied the current regulations on applicant conditions, they will be removed forcibly from low-rent housing and replaced by those in the waiting list.

Low-rent housing and Public rental housing may confuse some people, due to their similar name and similar target families. Generally, there are two major differences between them. Firstly, low-rent housing applicants are required to have the urban *hukou*

of the city while there is no like requirement for public rental housing applicant. Secondly, the rent for public rental housing is much expensive than low-rent housing. For instance, the rent of a low-rent housing unit (50m²) in Shenyang city is around 25 RMB. By contrast, the rent of a public rental housing unit (50m²) may reach 400 RMB, 16 times higher than a similar low-rent housing unit.

So far, low-rent housing system has been established for around 15 years. It experienced several transformations in the development to address the new issues, just as the affordable housing system development. However, there are still several shortcomings in the current system. Some shortcomings also could be found in affordable housing system, such as the construction fund shortage and imperfect policies and regulations. Meanwhile, the overly limited beneficiary of the policies and the inequality in the process of allocation both make the system questionable. Additionally, low-rent housing construction is imbalanced between eastern and western part of China, due to different financial income. Generally speaking, the families that could enjoy low-rent housing policies in eastern part of China are 4.17 times as many as those in western area. Low-rent housing construction in big cities is basically better than middle and small local cities.

2.3 Public Housing in Shenyang City

Shenyang city is the largest city in northeast China with a population of 7.18 million⁴. According to the city statistics of 2010, the average housing space of this city had reached 32.8 m²; however, the housing problems of low-income residents in this city are still knotty. In 2010, the average disposable income of this city was 20,541 Yuan⁵ per person; while the average commercial

⁴ Data obtained from Shenyang statistic yearbook 2010, including population residing in city area and rural areas managed by Shenyang municipal government.

⁵ 1 dollar is roughly equal to 6.3 RMB.

residential housing price⁶ had reached 6,012 Yuan/m². That means one person can just afford about 3.4 m² using all of his income based on the premise that he has no other expenses at all; but this is impossible. Consequently, the situation of low-income residents has worsened.

Although the national regulations were issued earlier in the 1990s, the Shenyang local government has just successively formulated the local regulations about the public housing system; something it started in 2007. After a series of revisions, so far relatively systematic regulations have been introduced to direct public housing construction, allocation and operation.

In general, the public housing development in Shenyang city lags behind the overall housing market development. Prior to 2005, although the complete local public housing regulations had not been designed, the government had begun to provide public housing to eligible families under national regulations, and 807 units of low-rent housing and around 17,000 units of affordable housing were provided within this period. In the following two years, the majority of public housing available was provided via either a housing rental subsidy or a purchase subsidy, while the real housing construction had nearly ground to a halt. It proved to be an ineffective way to improve the living conditions of low-income residents, although some residents' living standards did be improved to some extent. Therefore, in 2008 the city government restarted the public housing construction and 1.2 million sq.m of affordable housing (around 20 thousand units) and 0.3 million sq.m of low-rent housing (around 6000 units) is to be provided by the end of this year. The area of new affordable housing projects in 2009 and 2010 should have reached 1.76 million sq.m, if all of them have been completed by now. Altogether, 29 thousand units

⁶ The commercial housing price data in Shenyang city is captured and analyzed monthly, the data adopted here was the commercial housing price in November 2011.

should have been provided. Regarding the public housing provision in 2011, it was 55 thousand units. Hence, it could be calculated that a total of 128 thousand public housing units have been provided to date⁷. According to the latest statistics, the number of household in Shenyang city has reached 2.5 million, the public housing provision in Shenyang city is till grossly inadequate. It is reassuring to see that the city government has realized the importance of public housing provisions and a considerable quantity of public housing is scheduled to be constructed in 2012. According to the statement of the government, 36,842 units of public housing will be completed in 2012, including 30,000 units of public rental housing targeting new citizens, migrant workers and recent college graduates⁸.

At Shenyang city, the public housing also experienced several transitions in the past a few years. The basic consideration of the new policies is the government must ensure that every citizen should be accommodated, through the way of renting rather than purchasing a public housing unit. Accordingly, the recent public housing construction plan focused on the public rental housing construction more than affordable housing. Low-rent housing in Shenyang will be provided by rental subsidy. There would be no real low-rent housing unit provided in the future, according to the government. Figure2-2 shows the newly built public housing projects in 2011, including nine public rental housing projects and four affordable housing projects. After all these projects completed, it will provides 21.8 thousands public rental housing units and 4224 affordable housing units. Apparently, the major public housing provision is composed of public rental housing affordable housing, in which public rental housing will account for more than

⁷ Data used for analysis obtained from Shenyang government working report. The calculation was made based on the assumption that the affordable housing and low-rent housing have fixed area, respectively 60 m² and 50 m².

⁸ See: <http://www.ln.chinanews.com/html/2011-12-06/399146.html>

70% of the total⁹.

Aside from the initiatives on improving provision, Shenyang government also regulated strict applicant requirements to ensure the public housing units to be distributed to those urgently needed. To apply for affordable housing unit, the applicants should satisfy the following requirement: (i) having the urban *hukou* of Shenyang city and living in the city three years at least; (ii) family per capita income lower than 70% of annual per capita income of the city released by government officially; (iii) having no house (exclude people who is renting the public housing or have enjoyed the previous housing supporting policies of housing reform) or the per capita living space lower than 70% of the average level of the city released by government in previous year. Thus, an urban *hukou* had become an important premise that one can apply for affordable housing. Meanwhile, the applicants' family income and living condition also are strictly regulated. Additionally, the provision of affordable housing is very limited, just four new projects were planned to start in 2011. Although, some commodity housing units bought by government from private developers are transformed to affordable housing provision. It still cannot meet the strong needs of legible families. To those people who don't have an urban *hukou*, applying for an affordable housing unit is impossible for them.

⁹ See details at: <http://sy.house.sina.com.cn/zhuanli/baozhangfangdayuejin/>

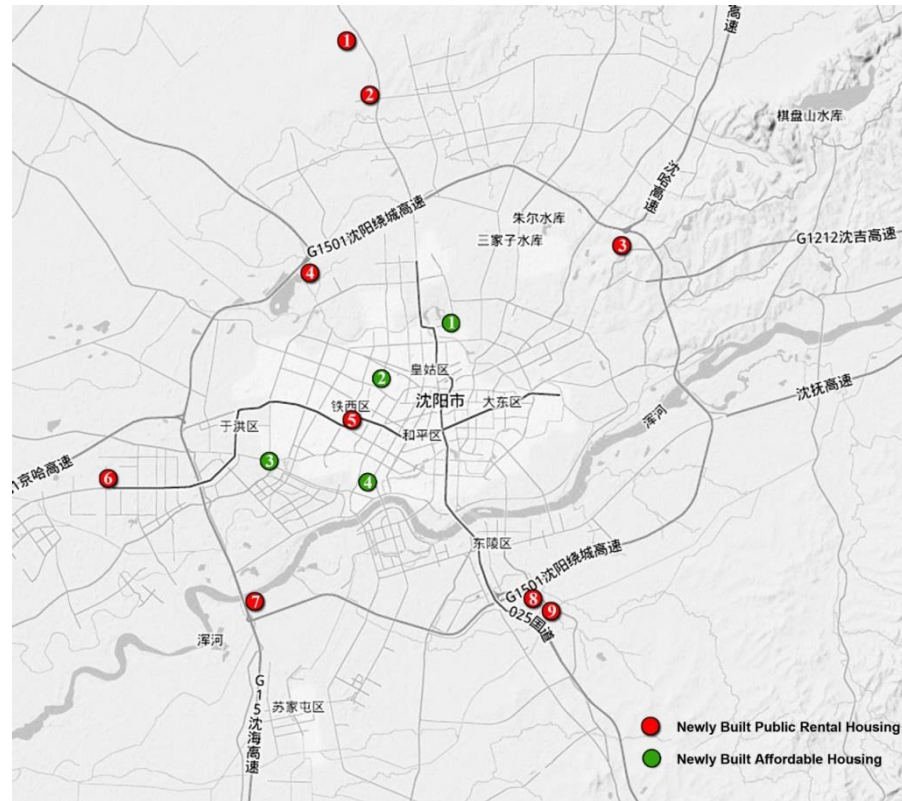


Figure 2-2 Distribution of newly built public housing projects in Shenyang city in 2011, including nine Public rental housing projects and four Affordable housing projects.

As we discussed in the previous section, public rental housing system is designed for those people who cannot afford the affordable housing and are not qualified for low-rent housing. According to Shenyang's local regulations, the applicants of public rental housing must meet the following standards: (i) for those people who have the urban *hukou*, his/her per capita disposable monthly income must less than 1700 RMB; the monthly income of single people must less than 2500 RMB¹⁰. The age of single applicant must reach 28 years old. Moreover, the per capita building area of applicants' family must less than 16m²; (ii) for migrant workers, there is no *hukou* limit. They could apply for public rental housing only if they comply with the requirements on

¹⁰ The disposable per capita monthly income of the whole city is 2202.5 RMB in 2012, according to released data from Shenyang local government. Detailed information is available at: <http://news.syd.com.cn/system/2013/03/26/010016621.shtml>

income and living space and pay social pension insurance over 1 year; (iii) for new college graduates, there is no requirements on *hukou* and income, but they must graduate three years ago or earlier, and have no house in Shenyang at the same time. Public rental housing will compose the main body of public housing provision in the future in Shenyang city. According to the public housing construction plan in 2011, nine new public rental housing projects will be constructed in the near future. Public rental housing projects usually are located where relatively far from the downtown area but easy to access to public transport, such as subway stations (Figure 2-2).

Low-rent housing has much more strict requirements on the applicants' income and their living space, compared to the other two public housing types. (i) All family members must have urban *hukou* of the city and living in the city; (ii) The applicants must provide the certifications of the lowest-income issued by department of civil affairs of the local city; (iii) The per capita housing area must be less than 16m²; (iv) Applicants must meet additional requirements developed by government. In Shenyang, people who have the certification of lowest income just have 125 thousand, account for around 2.4% of the whole population based on the statistical data of 2010¹¹. Most part of these people are enjoying rental subsidy from the government, just an extremely small group of them could live in a real low-rent housing unit. In future, the government will not build new low-rent housing, and all low-rent housing eligible family will be supported by rental subsidy. Public rental housing is generally the primary option for them. With the subsidy of the government, the low-rent housing eligible families can rent a public rental housing unit by cheaper price. Although there will be no newly built low-rent housing in the city, some units constructed several years ago are available for

¹¹ Data obtained from Statistical handbook of Shenyang, 2010.

the lowest income families. Shenyang government designed an assessment form to rank the families in the waiting list and then decide which family should be housed firstly. In this form, the elderly, disabled people, and multiple generation families could get a high score. As a result, they would be listed in the relatively first page. This maybe causes some special needs on housing interior environment. I will look at this issue in detail in the following several chapters.

2.4 Japan's Housing Policies and New Tendency

The housing policy and its development in Japan have similarities with those in China, and are referable for China to a certain extent. In this section, the housing policy in Japan and its development after World War II are introduced. In the discussion, Chinese housing policy also is mentioned as a comparable case. The comparative analysis is expected to be helpful to clarify the pressing issues about public housing development in China.

2.4.1 Housing policies development in Japan

After World War II, housing shortage was the most urgent issue to be addressed for the central government of Japan. The shortage was estimated at 4.2 million housing units. In order to tackle this issue, Government Housing Loan Corporation (GHLC) system, public housing system and Japan Housing Corporation (JHC) were established in 1950, 1951 and 1955, respectively. The according acts also were enacted at that time to regulate the practices. In this period of time, alleviating the housing shortage was the primary task for the government. Although considerable concerns were taken on the housing provision, the influx of immigrants into urban area and the increase of core families made the problem could not be solved easily. To promote the housing construction, not only the public corporations belong to state and local governments, but also the private housing construction was involved. Meanwhile, as a supportive strategy for the 5-year housing construction plan,

Housing Construction Plan Act was formulated. After that, the housing construction plan was made per five years from 1966 to 2005 (Table 2-2). As a result, around 55.1 million housing units were supplied in this period of time. As a milestone of the housing construction, the purpose of “one house per household” was achieved in 1973, and then the main purpose of the 5-year housing construction plan was transformed from improvement in terms of quantity of housing unit provision to it in terms of quality. In recent years, populations aging and low birth rates have become the crucial features of Japanese society. How to address the challenges arose from the new situation has to be seriously considered for current Japanese governments. Additionally, the bubble bankruptcy also pushed forward the reforms on previous housing system. Specifically speaking, three reforms on strategies were adopted. Firstly, the Urban Renaissance Agency (UR) was established in 2004, instead of JHC system which was abolished at the same time. UR takes the responsibility of the management of the original JHC houses and devotes to not only urban renaissance, but also improving the living environment in city, suburban environment and disaster redevelopment¹². Secondly, the GHLC was transformed to the Japan Housing Finance Agency (JHF) in 2007, which is an incorporated administrative agency wholly owned by the government. The direct housing loans to general public were abolished and the JHF focuses on enhancing securitization¹³. Concerning the public housing system, to accelerate the development of public housing system and meet the various housing needs in cities, the Local Housing Allowance system was set up in 2005. The local public corporations were given the right to use the state allowance according to their own situation and the supply of housing therefore could be more responsive.

¹² Detailed information is available at:
http://www.ur-net.go.jp/profile/english/pdf/profile_en_all.pdf

¹³ Detailed information is available at: <http://www.jhf.go.jp/files/100012580.pdf>

Table 2-2 Five-year housing construction plan in Japan

The purpose of plan		Housing construction plan and achievement (total number in 1000)	Housing construction funded by public investment (total number in 1000)
The 1 st term 1966-1970	The improvement of housing shortage One house per household	Plan: 6,700 Achievement: 6,740 <100.6>	Plan: 2,700 Achievement: 2,565 <95.0>
The 2 nd term 1971-1975	The improvement of housing shortage One room per person	Plan: 9,580 Achievement: 8,280 <86.5>	Plan: 3,838 Achievement: 3,108 <81.0>
The 3 rd term 1976-1980	The improvement of dwelling standard Minimum & ordinary dwelling standard	Plan: 8,600 Achievement: 7,700 <89.5>	Plan: 3,500 Achievement: 3,649 <104.2>
The 4 th term 1981-1985	The improvement of dwelling standard Minimum & ordinary dwelling standard	Plan: 7,700 Achievement: 6,100 <79.3>	Plan: 3,500 Achievement: 3,231 <92.3>
The 5 th term 1986-1990	The improvement of dwelling standard Ordinary dwelling standard	Plan: 6,700 Achievement: 8,284 <123.6>	Plan: 3,300 Achievement: 3,138 <95.1>
The 6 th term 1991-1995	The improvement of dwelling standard Ordinary dwelling standard	N/A	Plan: 3,700 Achievement: 4,017 <100.6>
The 7 th term 1996-2000	The improvement of dwelling standard Ordinary dwelling standard	N/A	Plan: 3,525 Achievement: 3,487 <98.9>
The 8 th term 2001-2005	The improvement of dwelling standard Ordinary dwelling standard	N/A	Plan: 3,250 Achievement: 1,182 <36.4> *Till March 2005

Note: <>: Rates of achievement

Data source: 日本の住宅事情と住生活基本法(2006)

2.4.2 **Housing policy development tendency in Japan**

After the 8th term of Housing construction plan, the housing stock had become adequate. Moreover, the new social issues, such as population aging and low birth rates, made the Japanese governments have to think of the new housing policy to address the new issues. Against this background, the Housing construction plan was abolished; instead, the Fundamental Act for Housing Policy was enacted in 2006. The ultimate objective of the act is to accomplish a kind of life that is not only related to house, but also a more safety community, various services of traffic and welfare, etc. It focuses on improving the quality of life. The act specifies four basic concepts, which also could be considered the indicator of development tendency of the housing policy in Japan. The following are the four basic concepts of the act and the specific strategies.

- a. To improve the quality of housing, including housing provision, management, etc. For instance, remodeling housing to be earthquake resistant, more energy efficient, and barrier free; a more competent apartment management.
- b. To form a pleasant living environment around the housing as well as the district. For example, eliminating the overcrowded blocks, shaping a beautiful streetscape, promoting the residence in downtown area;
- c. To reform the housing market for the flexible use of the current housing stock and consumer benefit protection. The specific strategies include promoting House performance indication system, providing useful information and support for house purchaser in case of dissension, supporting the relocation through letting the original house, etc.
- d. To ensure that those poor and needy who cannot afford the house in housing market could be accommodated. The main

approaches involve the provision of public housing and disaster recovery public housing, the provision of letting housing for the elderly and families who need to raise babies, the promotion of private letting housing which has no unreasonable limits on renter.

2.4.3 A comparative discussion on housing policy

Some similarities and differences between the housing policies in Japan and China are worthy to be mentioned. Firstly, they both focus on the middle and low-income groups and established according system. In Japan, JHC and the Local Housing Supply Corporation take responsibility of the housing construction for middle and low income people to improve the home ownership. In China, the local governments are in charge of all the public housing management. However, the public housing is jointly constructed by local governments and private real estate developers to relieve the financial burden on the governments. Secondly, the GHLC provide long term and low interest funds for people who want to build or purchase their own housing units in Japan. In China, a Housing Provident Fund system was set up which has a similar function with GHLC system. It is a kind of deposit jointly made by employers and employees. The deposit could be used to purchase a house in the housing market or rent a housing unit. It is a supportive policy to improve the homeownership. Thirdly, the population aging is a serious issue for both Japan and China. In the Fundamental Act for Housing Policy in Japan, a main objective is to provide comfortable housing for the elderly. In China, the elderly is given the priority to apply for a public housing unit. However, there are no related improvements on housing units to make them more usable for the elderly in China, which is a problem the Chinese government has to address in the future.

Based on the preceding discussion, I can summary several valuable experiences from the housing policies in Japan. The

governments in Japan enacted systematic acts to regulate the housing construction, funds and management. Additionally, these acts are evolved and amended to address new issues. But, in China, there is still no any national act about housing and the specific housing construction plan have not been made. Thus, perfecting the act system should be given enough attentions in China. The public housing provision in China is still inadequate; a similar situation just likes it in Japan after World War II. After the housing shortage in Japan was overcome, considerable emphasis was given on how to improve the quality of life in public housing. It is predictable that the public housing in China also will experience a similar process. Considering like issues in advance will avoid unnecessary home remodeling and reduce the financial burden on governments and individuals. The living environment improvement has become one of the objectives of the latest housing policies in Japan. The same, it is supposed to be very important for the success of public housing projects in China. However, the living environment in Chinese public housing projects was ignored in many cases. Concerns are centered on the housing unit in term of quantity. The living environment is considered a minor factor. Related researches had documented that living environment could affect residential satisfaction effectively. I will discuss it in detail in next chapter. It indicates that we have to place enough emphasis on living environment improvement, including the safety net in the community, pleasant streetscape, etc.

2.5 Conclusions

The pressing issues about Chinese public housing policies are summarized as the conclusion of this chapter.

a. The enactment of related acts and regulations. Some public housing related regulations and directives are available at present. Generally speaking, they are ignored in many cases. Since no housing act, different cities develop public housing individually

according to their own regulations. That leads to the imbalance in public housing construction among provinces. Hence, there is a high necessity to formulate a national housing act to regulate the practice in every province.

b. Dealing with the public housing shortage in terms of both quantity and quality. The housing shortage is still serious; therefore, many efforts are made on improving the housing provision. But, the quality of the housing unit is neglected. This perception implies that a large scale of remodeling may be necessary, which will cause additional expenses. Thus, from the very initial stage, the quality of housing unit should be carefully considered.

c. More attentions should be paid on the disabled and elderly. Many elderly and disabled people are living in public housing in China. As aging, the residents may express more needs for a usable and accessible environment. However, architects in China usually consider it will increase the design and construction cost and therefore are apt to take it out of consideration. But, how to meet the challenges arose from population aging is an inevitable question for our society. The earlier we think of it, the fewer problems we will face in the future.

d. Public housing design is as important as policy making. The Chinese literatures about public housing design are extremely limited as we discussed in chapter 1. The design can directly affect the quality of life of the residents and their satisfaction about the housing policy. If we only focus on perfecting our housing system and policies, we would never resolve the problems completely. A systematic and comprehensive solution is required.

2.6 References

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3 Residents' General Satisfaction with Housing Unit Features

3.1 Six Selected Public Housing Projects

There are six public housing projects were studied in this research, including two low-rent housing projects and four mixed public housing projects (both affordable housing and low-rent housing are provided in one project). The selection of the projects is based on the considerations about their location and scale. Basically, I chose one representative projects from one district¹. They are *Xianggongbei* in *Huanggu* district, *Guanquanyuan* in *Dadong* district, *Fanrong Xindu* in *Tiexi* district, *Qingyang* in *Dongling* district, *Heping Xinju* and *Anmin* in *Heping* district. Five projects are located at central district and one project is located at the peripheral district (Figure 3-1). The basic information about these six projects is compiled into the table3-1. Relatively, *Fanrong Xindu* and *Guanquanyuan* are larger than the other selected

¹ Shenyang city has nine districts, including five central districts and four peripheral districts. The central districts refer to *Heping* district, *Shenhe* district, *Dadong* district, *Huanggu* district and *Tiexi* district. Four peripheral districts are *Sujiatun* district, *Dongling* district, *New Shenbei* district and *Yuhong* district.

projects based on the provision.

Table 3-1 Basic information about the studied projects*

Project Name	Composition	Housing unit provision	Building area (m ²)	Completion year
Xianggongbei	LH	387	19,350	2010
Guanquanyuan	LH & AH	5000	250,000	2005
Fanrong Xindu	AH	16700	1,000,000	2009
Qingyang	LH & AH	319	20,572	2008
Heping Xindu	AH & LH	792	53,100	2009
Anmin	LH	287	13,800	2008

*Note: Data used here is based on the released information on the internet. LH: low-rent housing; AH: affordable housing.

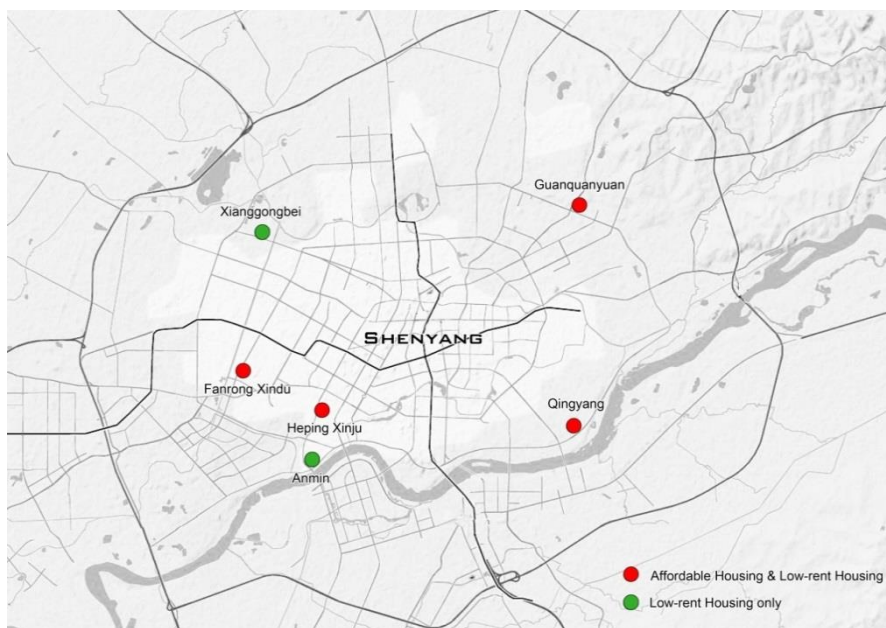


Figure 3-1 Distribution of the project cases. There are four mixed projects and two low-rent housing projects.

The following are the site plan of the six projects and the images of the surroundings. The site plans are made according to the Google map and the pictures taken by the author. These pictures aim to show the direct and general image about the projects. In the site plan map, the boundary of the project is indicated by a red dotted line. The buildings on the project sites are highlighted by dark black. The height of the building is distinguished by the darkness of the color. The darker the color is, the higher the building is. The transparent black represents shadows of the buildings.

(i) Site plan of *Xianggongbei* project and the surroundings. (Figure 3-2 & Figure 3-3)

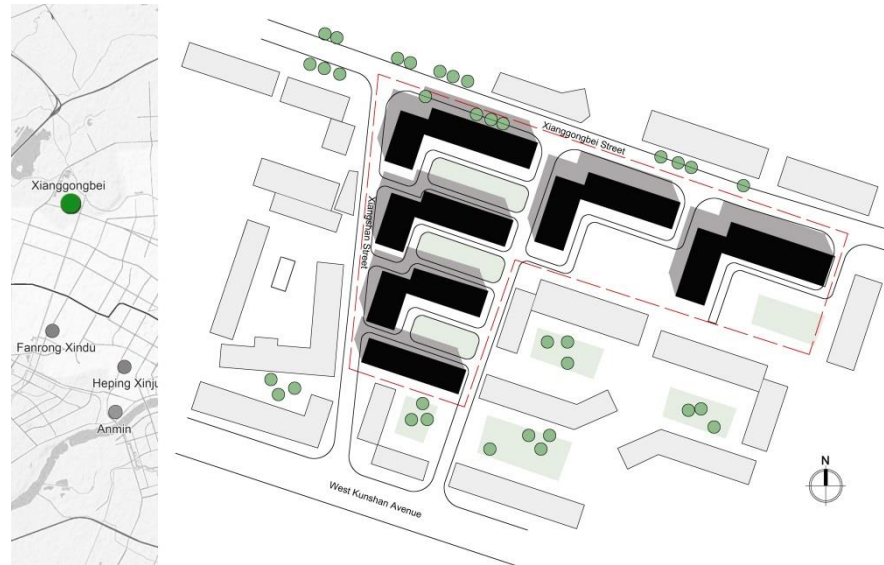


Figure 3-2 Site plan of *Xianggongbei* project



Figure 3-3 Environment in the *Xianggongbei* project and the surroundings

(ii) Site plan of *Guanquanyuan* project and the surroundings.
(Figure 3-4 & Figure 3-5)

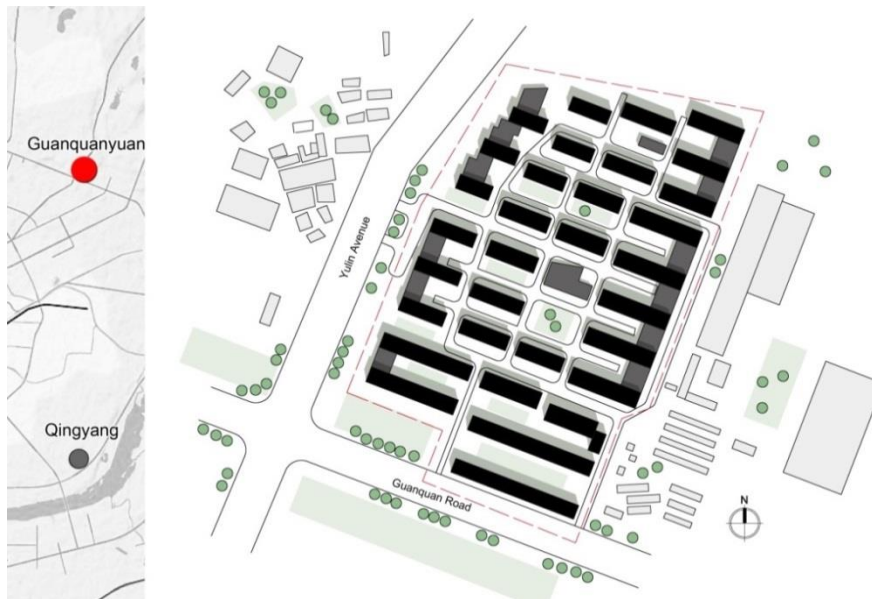


Figure 3-4 Site plan of *Guanquanyuan* project



Figure 3-5 Environment in the *Guanquanyuan* project and the surroundings

(iii) Site plan of *Fanrong Xindu* project and the surroundings.
(Figure 3-6 & Figure 3-7)



Figure 3-6 Site plan of *Fanrong Xindu* project



Figure 3-7 Environment in the *Fanrong Xindu* project and the surroundings

(iv) Site plan of *Qingyang* project and the surroundings. (Figure 3-8 & Figure 3-9)

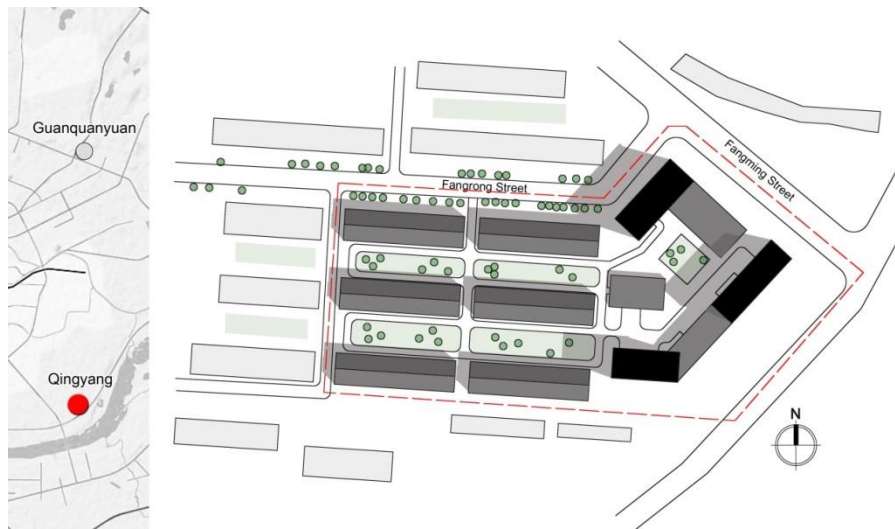


Figure 3-8 Site plan of *Qingyang* project



Figure 3-9 Environment in the *Qingyang* project and the surroundings

(v) Site plan of *Heping Xinju* project and the surroundings. (Figure 3-10 & Figure 3-11)

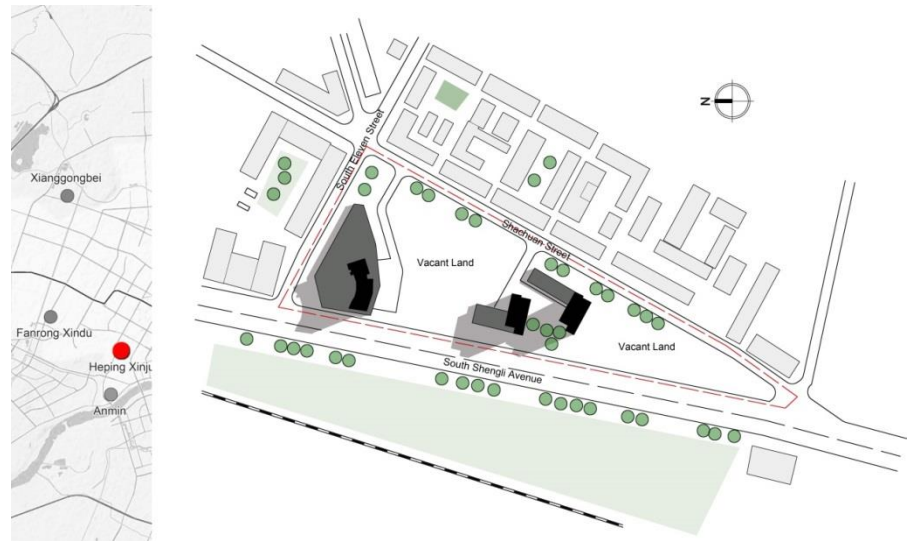


Figure 3-10 Site plan of *Heping Xinju* project



Figure 3-11 The surroundings of the *Heping Xinju* project

(vi) Site plan of *Anmin* project and the surroundings. (Figure 3-12 & Figure 3-13)

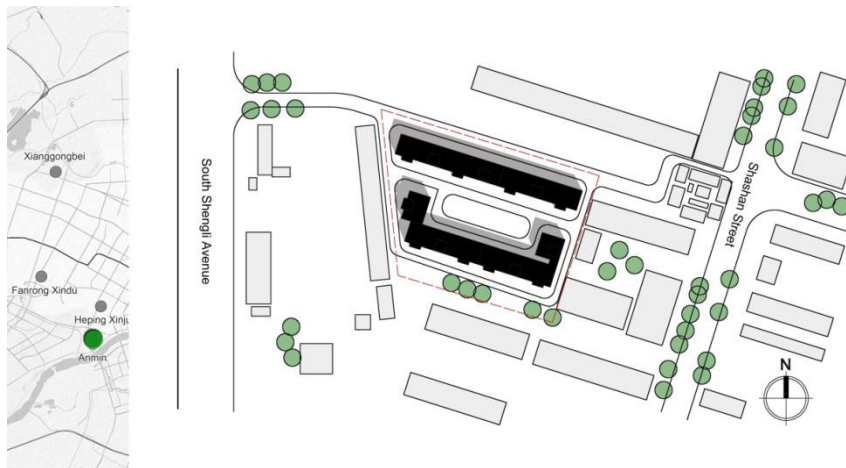


Figure 3-12 Site plan of *Anmin* project



Figure 3-13 Environment in the *Anmin* project and the surroundings

3.2 Questionnaire and Interview Survey

The main approach to get original data is two questionnaire surveys conducted in 2011 and 2012 respectively. Considering that people living in the public housing are low income ones, they may be reluctant to answer the questionnaire if I just give the question sheet to them and let them do it alone. Additionally, it might be difficult for some of them to fully understand each question, especially for the elderly residents. Thus, strictly speaking, the survey should be called an interview survey. The surveyors read the questions to the residents and will give more explanations about each question when the residents cannot understand (Figure 3-14). After they answered the question, the surveyors will fill the question sheet out according to the respondents. The surveys are completed by a group of students from department of architecture of Northeastern University in China. The students are divided in to three groups, two or three members in one group. One surveyor takes responsibility of finishing the question sheet. The other one or two surveyors are required to draw the sketch of the interior layout by hand and take interior pictures using a digital camera (Figure 3-15 & Figure 3-16). In this chapter, the answers of the questions are analyzed and discussed. The interior layout data will be discussed in detail in the next chapter which focuses on the housing unit typology.



Figure 3-14 Residents are being interviewed



Figure 3-15 Surveyors are sketching the interiors

In the 2011 survey, a total of 297 residents accepted our interview. There are 268 interior sketches obtained. Twenty-nine residents rejected our interview in their room, and just accepted the interview outside. Thus, the sketches of these housing units are missed. Most of residents are reluctant their housing interiors to be pictured. Few picture data is acquired in the survey. However, the picture data available could reflect several issues on the living environment which will be discussed later.

In the 2012 survey, a total of 103 residents accepted our interview. There are 101 interior sketches obtained. Only two residents refuse our request to sketch their interior layout.

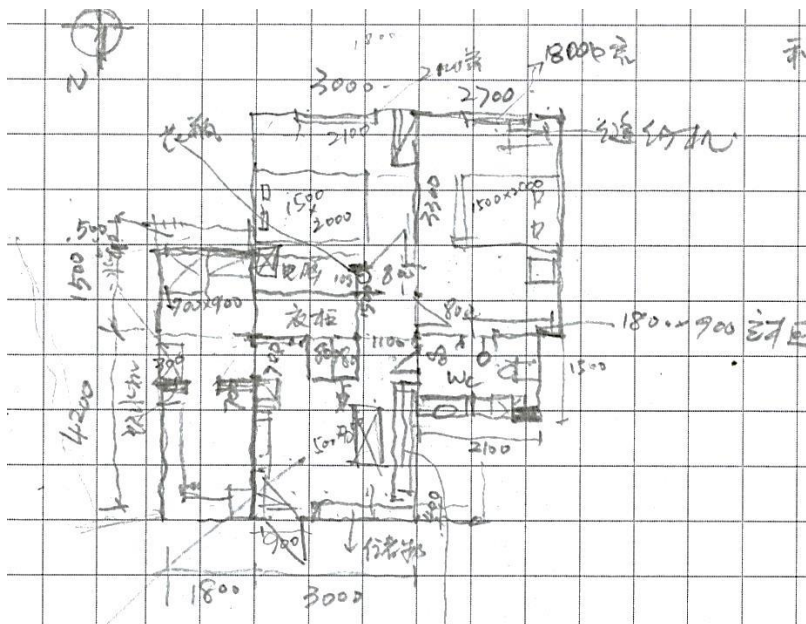


Figure 3-16 A sketch made by a surveyor

3.3 Residents' Satisfaction on Housing Unit Features

3.3.1 Previous studies about residential satisfaction

Chinese housing reform, in that public housing plays an important role, has always been a hot research topic (Chen et al, 2011; Wang, 2001; Shaw, 1997). The urban housing redevelopment was also frequently discussed by many researchers (Fang, 2006; Li & Song, 2009). These studies explored the roles of various factors, such as housing price, rural-urban migrants, finance and residential satisfaction, which presented valuable policy implications on urban housing reform. Nevertheless, physical environment like, building units and neighborhood facilities, are also relative to citizens' residential satisfaction in the public housing which had not attracted adequate concerns from Chinese researchers (Ma & Yuan, 2011). More specific studies are therefore required to answer questions like, "what does a "Housing" mean to low-income people?", "what are their preferences and living styles", features believed to achieve a comprehensive solution to improve the residents' satisfaction in public housing.

Developed countries like UK and USA conduct regular survey on tenant satisfaction to collect information about public housing performance (Varady & Carrozza, 2000). The residential satisfaction survey supplies an effective way to communicate with residents and adds a user perspective to the evaluations of public housing construction and design. Unlike China, where surveys are not regularly conducted, such valuable information is limited but now in demand in the recent years. In his study about affordable housing satisfaction in Beijing city, Li (2010) considered the categories of the inadequate neighborhood facilities, remote project location, long commuting distance and poor public housing management as major factors which were important, but left out and that had led to the dissatisfaction. Chinese cities are undergoing massive transformation in appearance and structure in

their recent economic boom. City redevelopment had caused residents to be displaced and relocated, where public housing becomes an important option for resettlement. Fang (2006) and Li & Song (2009) respectively took Beijing and Shanghai as case studies which, explored factors like residents' moving intention, moving behavior, housing conditions and residential satisfaction in the process of the city redevelopment. It was found that the unit size and the length of stay had a close relationship with the low level of satisfaction in Beijing (Fang, 2006). This finding in part supported the notion of Kinsey and Lane (1983), who suggested that more space in a dwelling contributed to a high level of satisfaction. However, unlike the low level of satisfaction in Beijing, the displaced residents in Shanghai were more satisfied with their housing conditions (Li & Song, 2009). Also, the previous residential satisfaction studies have indicated that residential satisfaction is a complex construct, which may be affected by housing types, tenure, cultures, socio-demographic attributes, housing price and the length of residency (Lu, 1999; Mohit et al, 2010). Since there is no general theory of residential satisfaction available, researchers inclined to study this issue through a comparative or correlative approach. Vera-Toscano (2008) studied "the relevance of social interactions on housing satisfaction" and Salleh (2008) observed how the neighborhood factors affected residents' satisfaction. These studies explored how a specific variable correlates with residential satisfaction.

In this section, we focus on housing unit features, which refer to the unit size, floor plan, bathroom, toilet, etc. They have been documented as important predictors of residential satisfaction. Mohit (2010) in his study on newly designed low-cost public housing in Malaysia found housing unit features has high positive correlations with residential satisfaction. Salleh (2008) also pointed out building features are strongly correlated with residential satisfaction. Furthermore, some micro-level studies on public

housing design in China implied the housing interiors in public housing were of poor unit quality (Zhou & Long, 2009; Zhou & Wang, 2009). Consequently, more studies on solutions to improve public housing unit features become pressing, such as the number of bedrooms, quality of housing unit, sizes of bathroom, which are closely related to residents' satisfaction with public housing in China.

3.3.2 Methodology

Data used in this study was obtained by a questionnaire survey conducted in six public housing projects in Shenyang city. Questionnaires were designed based on the research questions, which consists of three components. Firstly is the residents' socio-geographic attributes, including age, family size and type, occupation, educational level, income, etc. Secondly is residents' satisfaction with different housing unit features. According to Mohit (2010), housing unit features mainly refer to housing layout and internal spaces distribution and their quality, including living room, dining, bedroom, kitchen, bathroom, toilet and drying areas, and ventilation of the housing. Considering the cultural differences and living custom, we adjusted it to be congruent with the Chinese context. Dining and drying areas were not considered in this survey since they are usually designed within the kitchen and bathroom in Chinese housing unit. Bathrooms and toilets are usually located in the same space, thus, they were assessed as a single item. Thirdly is the residents' subjective comments on housing unit features and their aspiration, which provides us with additional information to assess their satisfaction level.

The SPSS was used to do descriptive analyses about respondents' socio-geographic attributes and correlation analysis. Respondents were asked to describe their subjective perception of housing unit on the following levels of satisfaction; "very satisfied", "satisfied", "dissatisfied", and "very dissatisfied". No neutral response was

provided, since a forced-choice question has been documented to make the data more accurate (Smyth et al, 2006). The Yeh's index number of satisfaction (YIS) was used to estimate residents' satisfaction in each housing unit feature, which is written in the following Eq. (1):

$$YIS=(S-D)/R \quad (1)$$

Where,

S = the number of respondents that are very satisfied and satisfied with one variable, D = the number of respondents dissatisfied and very dissatisfied with one variable and R = the total number of respondents.

This index ranges from -1 to +1. A larger index number indicates there are more respondents satisfied with one variable, conversely, a smaller index number indicates the dissatisfied respondents would be more. The absolute value of index number implies the degree of difference between satisfied and dissatisfied respondents.

3.3.3 Results and discussion

Respondents' Socio-geographic Attributes

The majority (which accounted for 56.3%) in the current public housing residents were in the age range from 40 to 60 years old (Table 3-2). Around four-fifth (79.1%) of householders were male. Most families (74.8%) had two or three members, including couples and their children. Single person families (23.7%) in low-rent housing were more common than those (9.5%) in affordable housing. Many residents in low-rent housing had no job (41.7%), or were retired (26.0%); the retired and freelance worker accounted for 25.0% and 23.3% in the affordable housing respectively. Generally, residents living in public housing have lower literacy level. Around half of them (48.6%) just finished junior high school education, with 23.6% of them graduated from

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Table 3-2 Demographic characteristics of the respondents in Low-rent housing (LH) and Affordable housing (AH) (n=297)

Characteristics	LH	AH	Total	LH (%)	AH (%)	Total (%)
Age						
20-29 yr	5	20	25	5.2	10.0	8.4
30-39 yr	12	32	44	12.4	16.0	14.8
40-49 yr	28	48	76	28.8	24.0	25.6
50-59 yr	29	62	91	29.9	31.0	30.6
60-69 yr	11	22	33	11.3	11.0	11.1
Over 70 yr	12	16	28	12.4	8.0	9.4
Total	97	200	297			
Gender						
Male	73	162	235	75.3	81.0	79.1
Female	24	38	62	24.7	19.0	20.9
Total	97	200	297			
Family type						
Single person	23	19	42	23.7	9.5	14.1
Couple only	22	47	69	22.7	23.5	23.2
Couple living with their child(ren)	23	91	114	23.7	45.5	38.4
Lone parent living with his/her child(ren)	17	11	28	17.5	5.5	9.4
Couple living with their parents and child(ren)	6	20	26	6.2	10.0	8.8
Other families	6	12	18	6.2	6.0	6.1
Total	97	200	297			
Family size						
1 member	19	13	32	19.6	6.5	10.8
2 members	36	59	95	37.1	29.5	32.0
3 members	35	92	127	36.1	46.0	42.8
4 members	3	24	27	3.1	12.0	9.1
5 members and more	4	12	16	4.1	6.0	5.4
Total	97	200	297			
Occupation						
Worker in state-owned enterprises	6	17	23	6.3	8.5	7.8
Worker in private enterprises	7	40	47	7.3	20.0	15.9
Civil servant	2	13	15	2.1	6.5	5.1
Freelance worker	16	53	69	16.7	26.5	23.3
Retired worker	25	49	74	26.0	24.5	25.0
Student	0	1	1	0.0	0.5	0.3
No job	40	27	67	41.7	13.5	22.6
Total	96	200	296			
Educational level						
Elementary school certificate	5	9	14	5.2	4.5	4.7
Middle school certificate	52	92	144	53.6	46.2	48.6
High school certificate	14	56	70	14.4	28.1	23.6
College or university's degree	8	21	29	8.2	10.6	9.8
Professional school graduate	8	16	24	8.2	8.0	8.1
No formal education	10	5	15	10.3	2.5	5.1
Total	97	199	296			
Per capita monthly income*						
Less than 500 Yuan	54	23	77	55.7	12.1	26.8
500-1000 Yuan	17	46	63	17.5	24.2	22.0
1000-1500 Yuan	12	57	69	12.4	30.0	24.0
1500-2000 Yuan	6	23	29	6.2	12.1	10.1
More than 2000 Yuan	8	40	48	8.2	21.1	16.7
Total	97	190	287			
Health status						
Good	31	113	144	32.0	56.5	48.5
Normal	21	57	78	21.6	28.5	26.3
Poor	45	30	75	46.4	15.0	25.3
Total	97	200	297			

Note: The total respondents of each characteristic may not be identical with 297 due to missing values.

* 1RMB approximately equals 0.16 dollar.

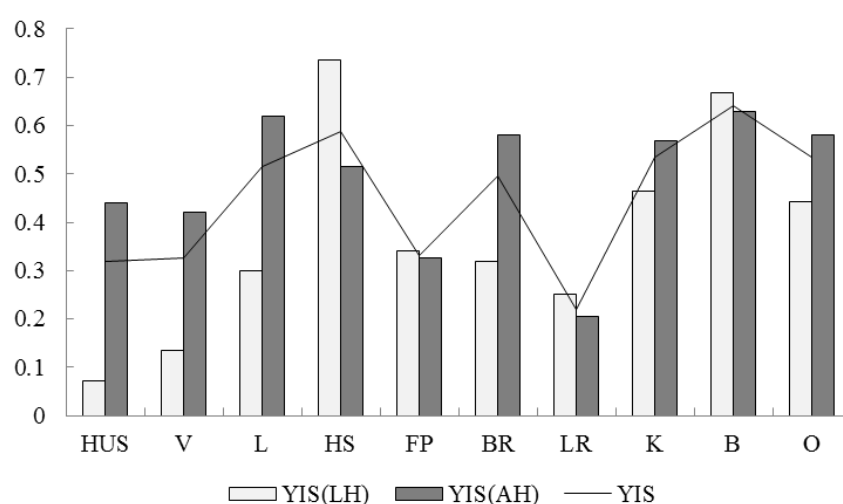


Figure 3-17 Comparison of indices of satisfaction about different housing unit features between affordable housing and low-rent housing. (HUS=Housing unit size; V=Ventilation; L=Lighting; HS=Heating supply; FP=Floor plan; BR=Bedroom; LR=Living room; K=Kitchen; B=Bathroom; O=Overall satisfaction with housing unit features.)

middle high school. The majority (72.8%) earned less than 1500 Yuan per month. The income of those in low-rent housing was much lower than those of affordable housing residents, more than half (55.7%) earned less than 500 Yuan per month. Almost half of the respondents (48.5%) generally consider the status of their health good. Nevertheless, those in low-rent housing had converse perception of their health, 46.4% of them thought their health was poor. In general, affordable housing residents had a relatively good financial situation and health status, there was no significant difference found in other characteristics.

Indices of Satisfaction about Different Housing Unit Features

Overall, in the “plus” indices of satisfaction, the number of respondents who were satisfied with housing unit features was more than those that were dissatisfied (Table 3-3). It is evident that the most satisfying feature for residents is the bathroom, of which the index of satisfaction reached 0.642, followed by heating supply at 0.588, and kitchen at 0.534. Relatively, residents were not so

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Table 3-3 Indices of satisfaction about different housing unit features

Housing unit features	S _(LH)	D _(LH)	YIS _(LH)	S _(AH)	D _(AH)	YIS _(AH)	YIS
Housing unit size	52	45	0.072	144	56	0.440	0.320
Ventilation	55	42	0.134	142	58	0.420	0.327
Lighting	63	34	0.299	162	38	0.620	0.515
Heating supply	79	12	0.736	141	45	0.516	0.588
Floor plan	65	32	0.340	132	67	0.327	0.331
Bedroom	64	33	0.320	158	42	0.580	0.495
Living room	60	36	0.250	120	79	0.206	0.220
Kitchen	71	26	0.464	156	43	0.568	0.534
Bathroom	80	16	0.667	163	37	0.630	0.642
Overall	70	27	0.443	158	42	0.580	0.535

Note: S=Satisfied; D=Dissatisfied.

satisfied with the living room as compared to other housing unit features. In the comparative indices of satisfaction with the low-rent housing and the affordable housing, significant differences could be found on “housing unit size”, “ventilation”, “lighting”, “heating supply” and “bedroom” (Figure 3-17). Except on “heating supply”, all unit features of affordable housing had similar or higher level of satisfaction, compared with the low-rent housing, which indicated a better living environment.

Housing Unit Size

The satisfaction index on housing unit size in the low-rent is much lower than in the affordable housing. This is probably caused by the current local regulations, in which the housing unit sizes of both types are strictly limited to 70m² and 50m² in floor space respectively. Furthermore, the qualification to access the public housing is determined based on one's income, while family size and type were not taken into consideration. Consequently, no matter how large one's household is, the size of public housing is fixed. For some large families in the low-rent housing, it is evident that the housing size is inadequate thus shows a deep dissatisfaction.

Ventilation

Ventilation is an important factor which could also affect

residents comfort. The data revealed that ventilation in low-rent housing was considered worse than that in affordable housing residents. Bathroom ventilation was bad since no artificial appliances were available to improve the foul air, which is partly blamed on the cheap construction cost as is strictly controlled by the government. Unlike affordable housing, investment in low-rent housing construction is from the central and local government coffers. Thus, local governments prefer limiting investment in public housing construction to save money that can be invested in other profitable sectors, like commercial housing development.

Lighting

According to residents, bad lighting was one of the most important factors for remodeling, especially the lighting in living room. Residents desired natural lighting into the living room. In order to fulfill this, residents create windows in the inner walls, a behavior which is both dangerous and hazardous to the residents' safety and health. Similar with ventilation, the lighting in low-rent housing was seen very poor by residents, as those of affordable housing type.

Heating Supply

Shenyang is a typical winter city, of which the average temperature is around -11.1 degrees centigrade (2011). Heating supply therefore is vital for residents in winter season. Though it has not been discussed as a component of housing unit in the previous studies. The data revealed that heating supply has a relatively high satisfaction level in the assessed features. The Low-rent housing residents were more satisfied than those at affordable housing. In fact, the heating condition fulfilled residents' desire for comfortable warm interior spaces.

Floor Plan

Comparatively, the floor plan had a relatively low satisfaction

level from both low-rent housing and affordable housing residents. The diversity of family types and sizes caused various space demands and needs, which the current floor plan types hardly fulfilled their demands or desire. Furthermore, the public housing distribution system, which didn't take the applicants' family type and size into consideration, is another significant cause for this situation. Consequently, remodeling becomes very common in housing typologies, even though it is prohibited in the housing regulations. The composition of family is also changing with new births and older people passing on. According to some residents, their poor health had led their incapability to work and could not earn enough for their special needs. Consequently, they have no choice but to live in the public housing for a relatively long period of time. The changing family composition therefore should be taken into account by both the architects and policy makers as an important point in the floor plans.

Bedroom

There is a significant difference found between the bedrooms of low-rent housing and affordable housing residents. The number of bedrooms is the issue at stake. Based on our investigation, many of the families (43.3%) in low-rent housing had three or more family members within the one bedroom housing type, under the current local regulations (50m² maximum). As a result, the incongruity between demands and supply caused the low satisfaction level. However, the number of bedrooms in affordable housing generally satisfied the demands of residents, therefore had a higher satisfaction level.

Living Room

Zhou & Wang (2009) argued that the more family member one household has, the wider living room it prefers in Chinese public housing. Most families (57.2%) interviewed had three members or more, which implied the need for a wider living room to guarantee

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Table 3-4 Correlation coefficient of each single feature with overall housing unit features satisfaction

	HUS	V	L	HS	FP	BR	LR	K	B	O
HUS	1									
V	0.430**	1								
L	0.307**	0.398**	1							
HS	0.130*	0.101	0.273**	1						
FP	0.424**	0.360**	0.298**	0.168**	1					
BR	0.418**	0.304**	0.270**	0.272**	0.414**	1				
LR	0.395**	0.353**	0.289**	0.190**	0.547**	0.486**	1			
K	0.301**	0.375**	0.284**	0.189**	0.482**	0.491**	0.508**	1		
B	0.279**	0.288**	0.218**	0.289**	0.298**	0.414**	0.373**	0.470**	1	
O	0.468**	0.410**	0.348**	0.305**	0.498**	0.480**	0.562**	0.485**	0.408**	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Note: HUS=Housing unit size; V=Ventilation; L=Lighting; HS=Heating supply; FP=Floor plan; BR=Bedroom; LR=Living room; K=Kitchen; B=Bathroom; O=Overall satisfaction with housing unit features.

a more satisfying space. Currently, the living room in public housing apparently did not satisfy the part on residents' needs, thus obtained a relatively low satisfaction. This supports the notion of Zhou to some extent. In some big families, the living room also functioned as a temporary place for sleeping or dining. The diversity of living room usage requires more space which is difficult to achieve in the context of current strict regulations on housing size.

Kitchen and Bathroom

Generally, the residents were satisfied with the kitchen and bathroom in both the low-rent and affordable housing. The differences of YIS in kitchen and bathroom between the two were slight. Nevertheless, from the architects' perspective, the environment in the kitchen and bathroom were unsatisfactory, which supports the residents' dissatisfaction, though they just inclined to say as satisfying. This revealed the residents having a high tolerance to foul spatial environment, as compared to the bedroom and living room.

Correlation Analyses

The correlation between overall satisfaction with housing unit

and other single unit feature was evaluated and compiled into Table 3-4. The higher the correlation coefficient, the closer correlation the features have with residents' overall satisfaction with housing unit. The results indicated that the living room has the highest correlation ($r=0.562$) with residents' overall satisfaction, followed by floor plan ($r=0.498$) and kitchen ($r=0.485$). Consequently, the living room has high positive correlation with the residents' satisfaction of housing unit. Meanwhile, the correlation coefficient of living room and floor plan which also exceeded 0.5, revealed a high positive correlation as well. It imported the living room played an important role in the process of assessment. According to the residents' subjective comments, the inadequate space and bad lighting were the main factors to determine satisfaction. In Figure 3-18, X-axis and Y-axis respectively stand for YIS and Pearson correlation coefficients. Spots located in the second quadrant indicate that these features have relatively low satisfaction level while a high correlation with residents' overall satisfaction with housing unit. Thus, improving living room, floor plan, housing unit size and ventilation may positively affect residents' satisfaction and should be paid special

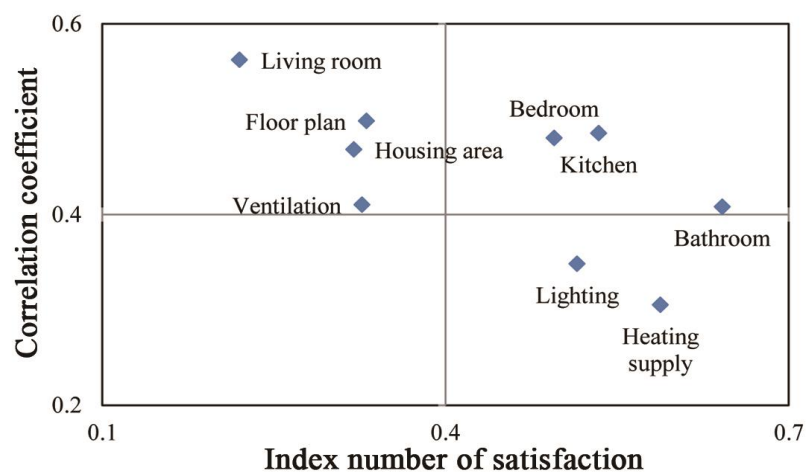


Figure 3-18 Priority of improvement to satisfy more public housing residents. The Living room, Floor plan and Housing area are features which highly and positively correlated with residents' overall satisfaction but assessed worse.

attention to.

3.3.4 Conclusions

In general, the affordable housing residents were more satisfied with housing unit features than the low-rent housing residents. The most dissatisfying features were the living room, followed by housing area and floor plan. In the low-rent housing residents, current public housing failed in providing them with enough bedrooms which was a major reason for the low satisfaction. In contrast with the low-rent housing residents, affordable housing residents inclined to pay more attention on living room and floor plan. Space for family activities had become their focal concern instead of the number of bedrooms. The analysis revealed that the living room had a high positive correlation with the residents' overall satisfaction on housing unit features, followed by floor plan and kitchen. Briefly, improving the living room, floor plan, housing area and ventilation are more effective and efficient ways to alleviate residents' dissatisfaction on their housing units.

The housing unit features were usually estimated as a single variable in other relevant studies on residential satisfaction from Chinese scholars (Fang, 2006; Li & Song, 2009). But, this study discusses and tries to determine how each unit feature correlates with the overall satisfaction. As discussed in the previous section, this will play an important role for architects in public housing design and building remodeling practices. Moreover, the findings are also valuable for detailed policy and design code making.

3.3.5 Policy and design implications

The study reveals that the inadequate housing unit size was an important reason for low-rent housing residents' low satisfaction on housing unit features. Related studies also found the positive correlation between housing unit size and residential satisfaction (Varady & Preiser, 1998; Kaitilla, 1993). These studies imported

that current local regulations, in which the housing area of low-rent housing is restricted into 50m², pressingly need some modifications. Policy makers should take family type and size into consideration and provide more diverse housing unit to satisfy different families. Additionally, ventilation was also highly correlated with residents' satisfaction which obtained a low satisfaction, thus deserves improvements. Notwithstanding a limited construction budget, necessary artificial appliances should not be ignored, which is particularly helpful to improve residents' satisfaction in the housing unit features. Relatively, affordable housing residents are satisfied with the housing size (limited into 70m²) and the number of bedrooms (usually two bedrooms). Generally, the low-rent housing, which targets the lowest stratum of social income, should attract more attention from policy makers.

Public housing designer should pay more attention on living room design and floor plan. Residents demand a wider living room to support their diverse family activities, such as dining, temporary sleeping and family meeting. Zhou and Long (2009), in their study of daily life on behavior of low-rent housing residents, argued that if the gross housing area is fixed, the living room should be wider. In 2009, Zhou also found that big size families (three family members or more) prefer wider living room to wider bedroom. Additionally, our study indicates living room is highly and positively correlated with residents' overall satisfaction with housing unit features while obtained a low satisfaction. All these studies demonstrate that improving the size and quality of living room would considerably increase the residents' satisfaction. Floor plan is another important factor affecting residents' satisfaction. To fulfill their special demands on unit spaces, many residents remodeled the original floor plan, which may cause an increase in family expenditure, when a new family moves in. Consequently, a flexible floor plan which enables residents to do some subtle changes on floor plan may be preferred.

3.4 The Living Conditions of the Elderly and Disabled

3.4.1 Population aging and the disabled in Shenyang

The population aging is a serious issue for all countries in the world. In 1950, there were 205 million people aged 60 or older throughout the world. Only three countries (China, India and United States of America) had more than 10 million people 60 or older at that time. Fifty years later, people aged 60 or older had increased about three times to 606 million, in which Chinese account for 21.3% (129 million) (UN, 2002). Therefore, China will face a more serious challenge come from population aging than the other countries. The population in Shenyang city is gradually increasing year by year, a similar thing is happening in most Chinese cities (Table 3-5 & Figure 3-19). At the same time, the percentage of the elderly in the whole population is also increasing continuously and will not stop in future. Population aging have been bringing many social issues, including the rapidly increasing state expense on pension, the needs for caring apartments and other supporting facilities. Many scholars, policy makers and specialists are exploring an effective way to address the diverse issues arose from population aging. For instance, how to reform the “one child” policy has become a popular topic in both academic field and the public, which is considered a key reason for population aging. In public housing, since a priority is given to the elderly when they apply for public housing units, population aging in public housing is more serious than it in commercial housing.

"Disability will affect the lives of everyone at some point in their life, it is time society changed to acknowledge this"

According to U.S. Social Security Administration, one-quarter of 20-year-olds will become disable by age 67. Currently, one in five people in America has a disability. In China, a similar situation

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Table 3-5 Aging population in Shenyang city

Year	60 and older population (10 thousand)		Total population (10 thousand)		Percentage (%)	
	U & R	U	U & R	U	U & R	U
2011	128.7	93.8	722.7	519.1	17.81	18.07
2010	122.7	89.4	719.6	515.4	17.05	17.35
2009	111.9	81.8	716.5	512.2	15.62	15.97
2008	109.2	79.6	713.5	509.0	15.30	15.64
2007	105.7	77.8	709.8	504.9	14.89	15.41
2006	102.2	76.0	703.6	499.9	14.53	15.20
2005	N/A	N/A	698.6	495.9	N/A	N/A
2004	99.8	74.8	693.9	492.3	14.38	15.19

Note: U&R: Urban and Regional area; U: Urban area

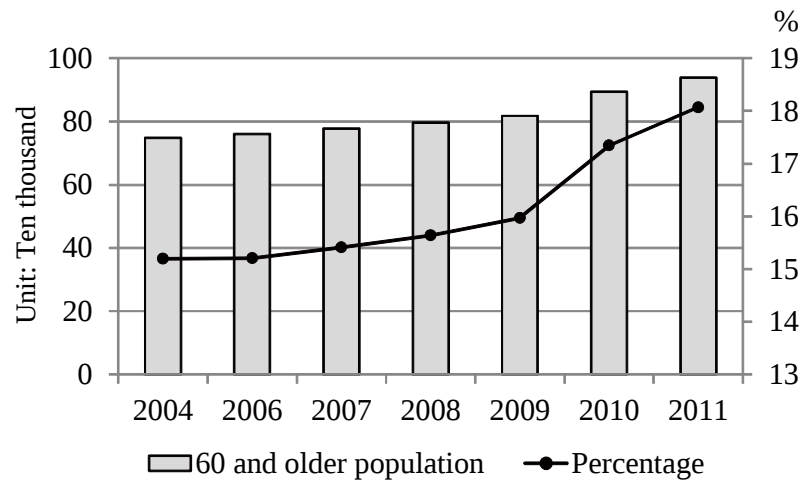


Figure 3-19 Population aging tendency in Shenyang city. From 2004 to 2011, the percentage of 60 and older population was increasing continuously.

could be found according to National Bureau of Statistics, who conducted the second national survey on the disabled in 2006. Base on the released data, 17.8% of Chinese families have disabled family member, in which 12.43% of the surveyed families have two or more disabled members². In the study city Shenyang, 384 thousand of people have a disability, account for 5.29% of the population, according to a survey in 2008. The disabled is an important component of the disadvantaged groups. They are suffering from many inconveniences and inequality when access to public spaces and buildings or searching a job. According to the

² Detailed information is available at:
http://www.gov.cn/fwxx/cjr/content_1311943.htm

survey in 2008, Shenyang has 43194 disabled people who have the ability to work. However, only 7.24% of them can find a job in the city (Liu et al., 2010). Similar with the elderly, they also are given priority when they apply for a public housing unit, due to their limited ability to work and relatively low income. Moreover, everyone may suffer from temporary disability at a certain time and people also will lose some abilities as aging. But, the current public housing designers seldom takes their needs into consideration. Public housing units are extremely unfriendly for them to use.

3.4.2 Survey on the elderly and disabled in public housing

In order to grasp the general living conditions of the elderly and disabled in public housing unit, I conducted a survey focused on the elderly and disabled in the six study projects. The information, such as household type, age, health status, is collected through a questionnaire and face-to-face interview. Totally, there are 103 families answered our questionnaire and accepted our interview, including 72 affordable housing residents and 31 low-rent housing residents (Table 3-6). All of the surveyed families have elderly family members or disabled family members.

As aging, people will be easier to become disabled which may be caused by accidents or some diseases. In this survey, 18 families have both elderly and disabled family members, which supported the idea in part. Seventy-eight families have elderly family members only and 7 families have disabled families only. Concerning the age distribution, 58% of the elderly aged from 60 to 74 years old, 35.5% aged from 75 to 84 years old and 6.5% of them aged 85 or more. Similar with the last survey, the family types of “lone parent living with his/her child(ren)” and “couple living with their parents and child(ren)” account for 55% of the interviewed families. It indicated that multiple generation families are common in current Chinese public housing. The majority (which account for 80.5%) families earn a monthly income less

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than 1500 Yuan, in which one third families earn less than 500 Yuan. Most of respondents considered their health status as “good” and “normal”, account for 80.6%.

Table 3-6 Characteristics of the surveyed families (n=103)

Characteristics	No.	Percentage (%)
<i>Public housing type</i>		
Affordable housing	72	69.9
Low-rent housing	31	30.1
Total	103	
<i>Family members</i>		
Having elderly family member only	78	75.7
Having both elderly and disabled family member	18	17.5
Having disabled family member only	7	6.8
Total	103	
<i>Age of the elderly family members</i>		
60-64 yr	36	29.0
65-74 yr	36	29.0
75-84 yr	44	35.5
85 yr and over	8	6.5
Total	124	
<i>Household type</i>		
Single	8	7.8
Couple only	24	23.3
Couple living with their child(ren)	7	6.8
Lone parent living with his/her child(ren)	24	23.3
Couple living with their parents and child(ren)	31	30.1
Other families	9	8.7
Total	103	
<i>Per capita monthly income*</i>		
Less than 500 Yuan	26	25.2
500-1500 Yuan	57	55.3
1500-2500 Yuan	18	17.5
More than 2500 Yuan	2	1.9
Total	103	
<i>Health status</i>		
Good	38	36.9
Normal	45	43.7
Poor	20	19.4
Total	103	

*Yuan is the unit of RMB. 1 Yuan approximately equals 0.16 dollar

In the questionnaire, the respondents are required to assess the unit features (entrance, living room, kitchen, etc.) and building features (corridor, building entry and stair well) as “very satisfied”, “satisfied”, “dissatisfied”, and “very dissatisfied”. YIS is used here as the indicator of residents’ satisfaction level. The assessed items in this survey differed from the first survey I conducted on

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Table 3-7 Indices of satisfaction about different unit and building features

	Very satisfied	Satisfied	Dissatisfied	Very dissatisfied	Total	Missing	YIS
Unit entry	26	55	16	6	103	0	0.573
Living room	15	36	34	15	100	3	0.020
Bedroom	29	44	20	9	102	1	0.431
Kitchen	22	48	27	6	103	0	0.359
Bathroom	15	55	24	9	103	0	0.359
Balcony	20	31	20	3	74	29	0.378
Storage space	5	2	21	14	42	61	-0.667
Corridor	22	46	25	10	103	0	0.320
Stair well	15	45	27	14	101	2	0.188
Building entry	16	58	20	9	103	0	0.437

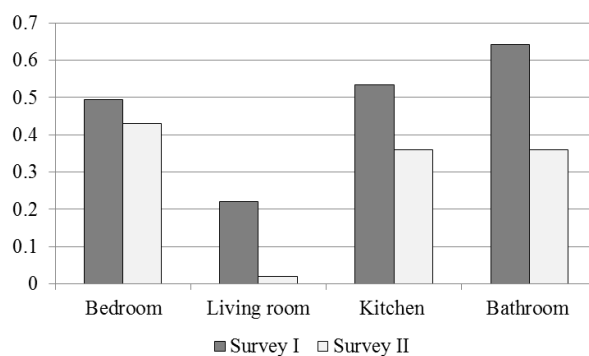


Figure 3-20 Comparison of data between two surveys. The YISs of these four features in Survey II are lower than it in Survey I, which indicates the elderly and disabled have a lower satisfaction.

residents' satisfaction on unit features. New items, "unit entry", "balcony", "storage space", "corridor", "stair well" and "building entry", are added in the assessed list to cover the subspace in the housing unit and some building features which closely relate to the accessibility and usability of the built environment. Data is compiled into Table 3-7.

According to the data on the satisfaction, most of YIS is plus that indicated more people satisfied with these features apart aside from "storage space". It seems the living conditions of the elderly and disabled are not so bad. However, if a comparative analysis with the results of the first survey is made, some noticeable points could be found (Figure 3-20). Compared to the first survey data, the satisfaction levels of the four main spaces, "bedroom", "living room", "kitchen", and "bathroom", decreased to different extents. Another noticeable thing is the missing value of "balcony" reached

29 that indicated many housing units don't have a balcony. Although the balcony was not assessed as an individual item in the first survey, tenants in the low-rent housing unit (Anmin project) still expressed their strong desire for a balcony. A balcony usually is used for laundry airing and storage, which is also an integral part of a usable housing unit. The YIS of storage space is -0.667, which implies that more respondents are dissatisfied with the storage space design of the housing unit. Generally, storage space design is ignored in many cases, particularly in public housing design which is perceived as a low standard design by many building designers. The assessment about different features was made based on the current living environment of residents. Owing to no decoration is made before they moved in; many storage spaces were designed by the actual occupants according to their needs. Their limited expertise usually leads to unreasonable design and may cause redecoration in the future. This is an important reason for their dissatisfaction. Concerning the building features, in spite of their plus YIS, the scores are relatively lower than the average level. That indicated improvements are needed if the architect want to design a more usable public housing building.

A summary could be made based on the data and analyses. More care is desired to be taken on public housing design for the elderly and disabled residents. They felt less satisfied with their living conditions and call for more conveniences in their daily life. Especially for those lowest income people, who have no money for home modification, they have to suffer more obstacles caused by unreasonable design. As the population aging being serious, the needs for improving accessibility and usability of the housing unit will be more pressing, or we will fail to address the various issues arose from population aging.

3.5 Conclusions

In this chapter, I described the two surveys about the public housing projects and explored the residents' satisfaction with housing unit features. The elderly and disabled also be discussed as

an integral component of occupants of public housing and was given a particular care. Generally, I can conclude the main findings of this chapter as following:

a. Generally, affordable housing unit size is wider than low-rent housing and accordingly was assessed better than low-rent housing unit. According to current local regulations on public housing, 70m² and 50m² are the maximum limit on affordable and low-rent housing unit size respectively. Therefore, only two bedrooms could be provided at most. For those multiple generation families, it is a crucial reason for low satisfaction.

b. The inhabitants in different public housing types have different concerns. For affordable housing inhabitants, living room and floor plan are their foci. They want a wider living room with regular shape to accommodate more family events and a more reasonable floor plan to get a better natural lighting and ventilation in the unit. In contrast, low-rent housing inhabitants pay more attentions on the housing size. Under the current low-rent housing regulations, only one bedroom is able to be provided. That means the family members have to share the bedroom or sleep in the living room in the multiple generation families.

c. The correlation analyses indicate living room, floor plan and housing size have a close relation with the inhabitants' satisfaction with the housing unit, but assessed worse. In other words, improving the quality of the three unit features will effectively alleviate the dissatisfaction from the residents.

d. Even though the elderly and disabled people in public housing are given priority when they apply for public housing unit, the building designers seldom take their needs for accessibility and usability into account. This led to their lower satisfaction, compared to the average satisfaction level. Meanwhile, their lower income makes it more difficult for them to remodel the housing unit. Their living conditions cannot be easily improved if we do

not consider their particular needs at the early stage of design.

e. The living custom of the elderly and disabled bring some additional needs on living environment. For instance, they prefer storing more foods at home, since it can reduce the amount of going shopping. Thus, more storage space is required in the design, which is missed in previous design practice.

Nowadays, China is experiencing a large-scale public housing construction process. Alleviating the shortage of public housing provision has become a focus of Chinese public policies. Intensive construction is supposed to achieve this aim in a relatively short period of time. Nevertheless, it doesn't mean we would never suffer new problems of public housing in the future. How to substantially improve residential satisfaction of public housing should be as important as the public housing provision in quantitative terms. This is the question which should be seriously considered by both the policy makers and building designers.

3.6 References

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4 Housing Unit Typologies Based on Room Usage

4.1 Floor Plan Data Processing

In the two surveys, a total of 369 floor plan sketches are obtained. These sketches are redrawn using AutoCAD, which is a software widely used in engineering field. Then, the digital floor plans are amended based on the interior pictures we took in the survey to improve the accuracy. The flow of floor plan data processing is shown in Figure 4-1.

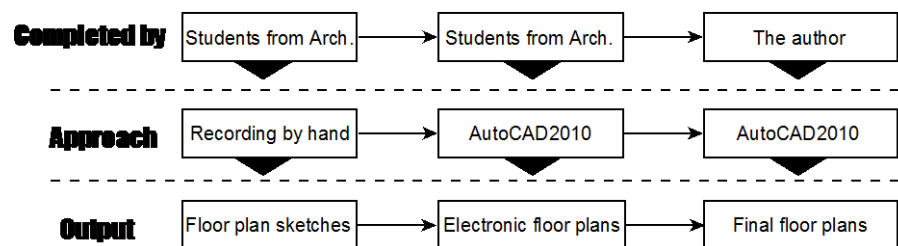


Figure 4-1 Data processing flow

The rough floor plan sketches are transformed to electronic floor plans by the surveyors. Since the electronic floor plans are made by different surveyors, the legend systems they used are varied. That leads to a different floor plan styles which are inappropriate to

do comparative analyses. Hence, the author employs a common legend system and modifies all the electric floor plans based on the common legend system. In addition, according to the interior pictures we got, some minor modifications are made in the final floor plans. The transformation of the floor plan is shown in Figure 4-2.

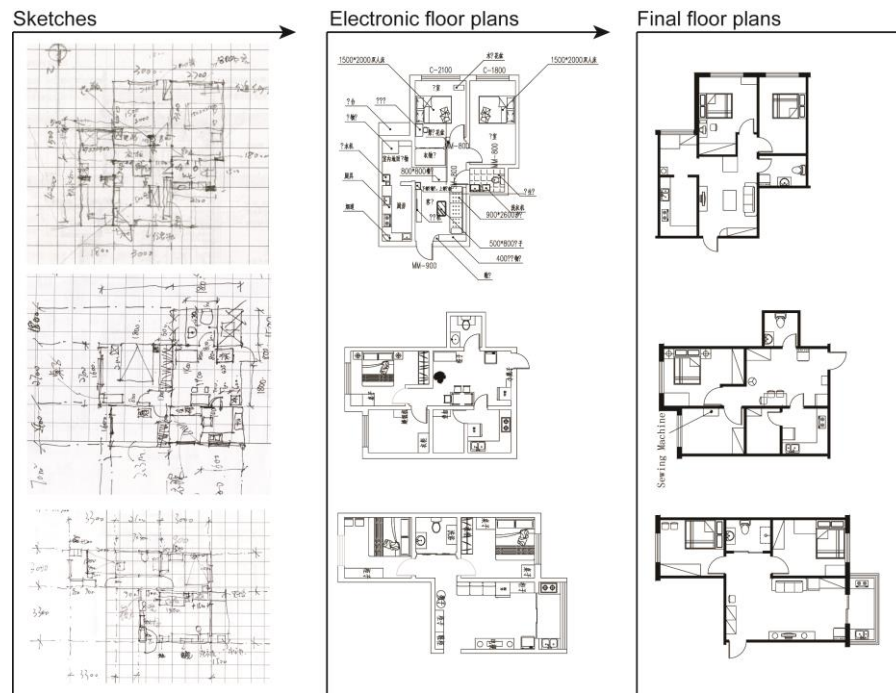


Figure 4-2 Transformation examples of the floor plans

4.2 Room Usage Classification

Housing unit categorizing is a useful way to deepen the understanding towards the current design strategy and practices. Household type and bedroom numbers are the main factors leading to different room usage. As we discussed previously, public housing unit size is restricted within 70 m² and 50 m² for affordable housing and low-rent housing respectively. Generally speaking, two-bedroom unit and one-bedroom unit are the most common. Since the household type have not been carefully considered when designed the regulations, it is very common that multiple generation families have to live in one-bedroom unit. This is an important reason for low satisfaction and the variety of room

usage. Thus, both the household composition and unit type are discussed in this section to explore the incompatibility between them and its impact on the room usage. Besides the household composition, some families have special living preferences, such as sleeping separately for some old couples. Hence, many factors might affect the room usage. However, all the factors could be summarized as that the living space is adequate or inadequate for the residents. If it had been inadequate, the residents would have to deal with the problem that how to accommodate all family members in the housing unit. Strategies, such as placing an additional bed in the living room or building partitions to divide a large space into small ones, are employed. Considering all the factors, a reasonable classification of room usage pattern is as follows:

Room usage pattern in:

Group (1) (G1): one-bedroom housing units, whose interior space is adequate for occupants;

Group (2) (G2): one-bedroom housing units, whose interior space is inadequate for occupants.

Group (3) (G3): two-bedroom housing units, whose interior space is adequate for occupants;

Group (4) (G4): two-bedroom housing units, whose interior space is inadequate for occupants;

Group (5) (G5): housing units which are remodeled to meet the special needs of occupants.

Data used for analysis is obtained by the two surveys discussed in the preceding sections. In the first survey, a total of 268 floor plans were obtained. In the second survey on the elderly and disabled, there are 101 floor plans were got. To make the room usage easier to understand, a common legend is adopted, which is showed in Figure 4-3. A few problems arose in the surveys are need to be pointed out before we enter the discussion on their room

usage. Because all the floor plans are drawn by hand firstly and then are transformed using AutoCAD into the form a computer can read. The accuracy of the room size therefore might be questionable. However, since their usage patterns are the foci of the study in this section, the accuracy of the floor plan cannot be seen as the critical factor affecting the room usage. Another issue is that the floor plans are drawn after the interviewer gets the permit of the householder. For many reasons, such as privacy or safety, the interviewer cannot get the complete floor plan of one housing unit at times. In this case, the arrangement of certain rooms is left vacant. And some of the floor plans are drawn according to the description of the householders.

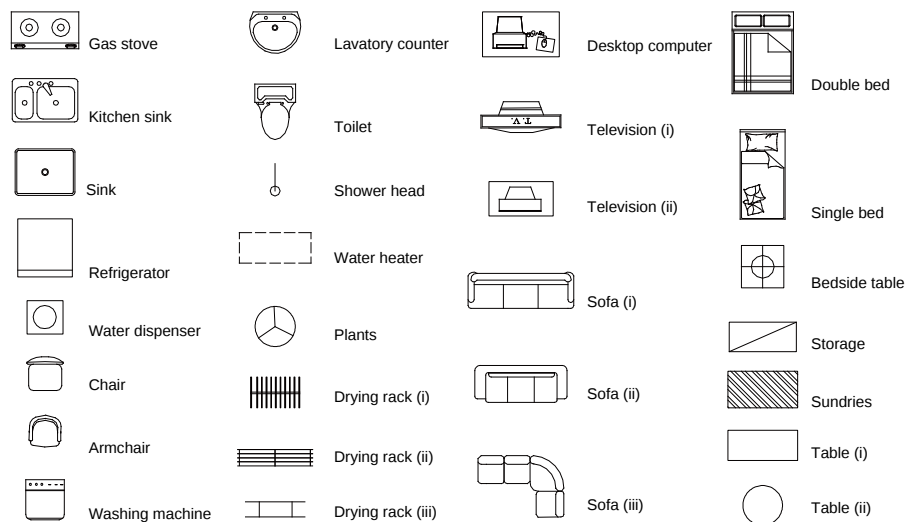


Figure 4-3 Legend for the floor plan

4.2.1 One-bedroom housing units (i)

There are 58 floor plans could be classified into this group. Each floor plan is given a number located at the bottom of the figure. Several noticeable features of the room usage are worth being pointed out. Since the household composition is couple only or single in general, the housing unit and room size is adequate for them. However, the interior environment is unsatisfactory. The major reasons could be summarized as follows. First, there is no decoration provided when the residents moved in. The wall and floor are simply plastered by concrete only. Even the toilet had not been equipped in some projects. The residents therefore have to

decorate the housing unit by themselves. According to the family economic status, the interior environment could be greatly different. Second, because there is no storage space provided in advance, many sundries are placed on the ground. This makes the interior environment worse. Additionally, the residents prefer using the balcony as the kitchen to save space for a wider living room. The figures from 4-4 to 4-9 show all the floor plans and room usage in this group.



Figure 4-4 Room usage in G1-01



Figure 4-5 Room usage in G1-02

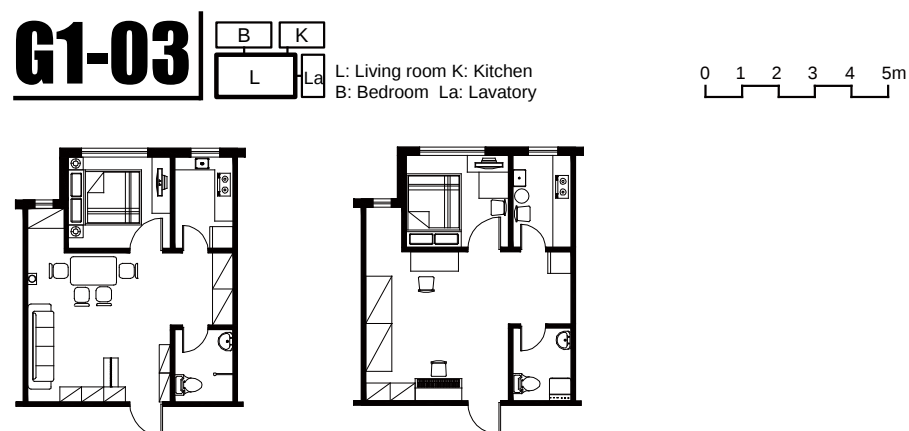


Figure 4-6 Room usage in G1-03



Figure 4-7 Room usage in G1-04

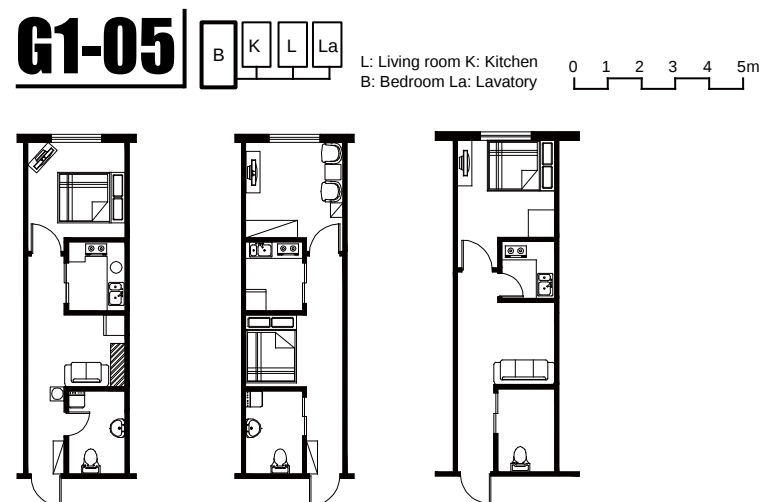


Figure 4-8 Room usage in G1-05

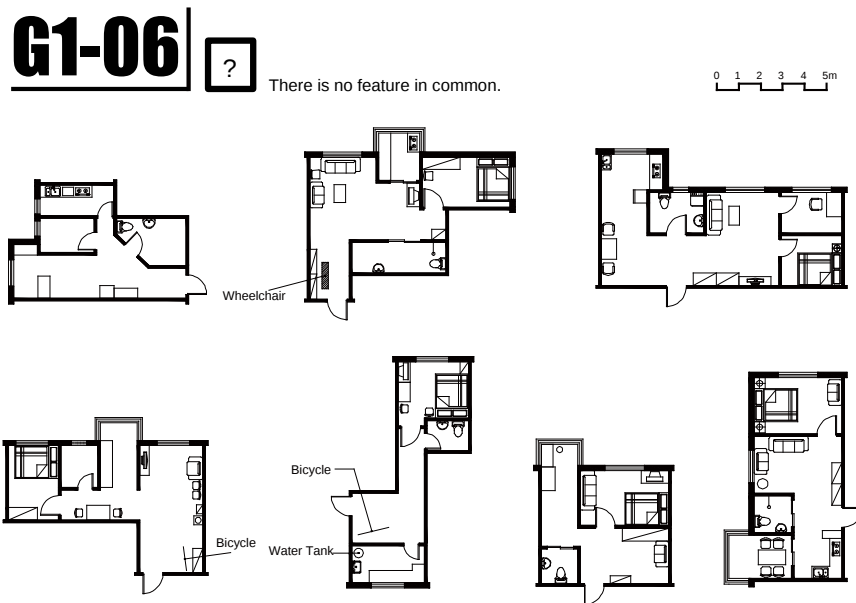


Figure 4-9 Room usage in G1-06

4.2.2 One-bedroom housing units (ii)

In this group, the residents' family size is larger than it of those living in the group one housing units. A direct consequence is one bedroom cannot meet their needs for sleeping separately. Additionally, a similar problem with group one also exist in this group. The family expense increasing caused by no basic decoration was available when they moved in. The interior environment of those who cannot afford the decoration is unsatisfactory, just same with it in part of housing units in Group one. The most common solution for the issue of inadequate bedroom is placing an additional bed in the living room. In some big families, two additional beds in the living room are required at times. The beds in the living room serve the function of not only a place for sleeping. It is also used as a seat when they meet with guests in the daytime and when they watch television at night. Since the family size is larger, the spaces for family activities become extremely not enough. The residents have to conduct various activities in the living room, such dining and studying. This is another feature of room usage in this group. How many functions the living room could serve determined by the size shape

of it. Generally, a wider living room with a relatively regular shape is easier to be used. A total of 58 samples were obtained in the survey and are showed from Figure4-10 to Figure 4-14.



Figure 4-10 Room usage in G2-01



Figure 4-11 Room usage in G2-02



Figure 4-12 Room usage in G2-03



Figure 4-13 Room usage in G2-04

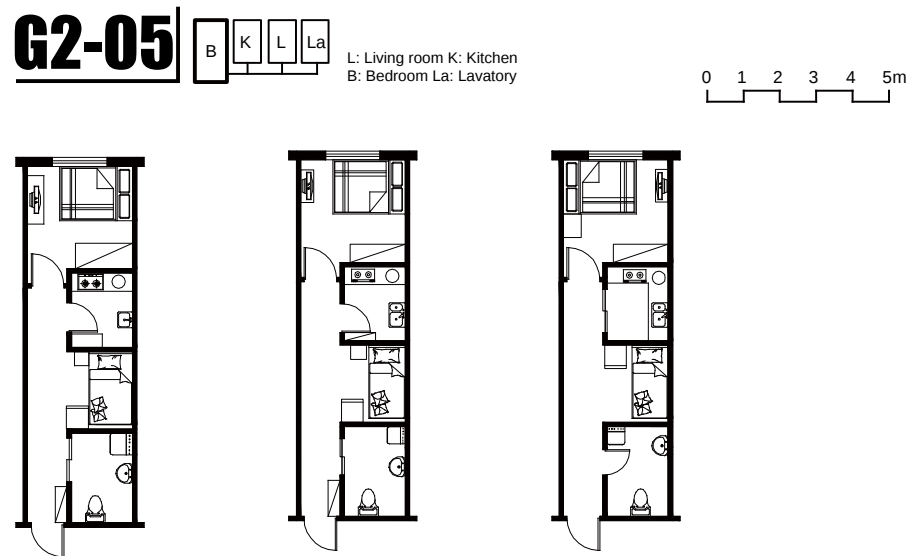


Figure 4-14 Room usage in G2-05

4.2.3 Two-bedroom housing units (i)

Two public housing types are designed for low-income group in China, which I have explained in the preceding chapter. Governments imposed housing unit size limits on both. For low-rent housing, the housing unit size limit is not wider than 50m^2 in many provinces. Generally, one bedroom could be designed in on housing unit if a conventional floor plan is adopted. Thus, the housing units including two bedrooms are affordable housing units in general. The room usage in this group of floor plan represents the most common situation in Chinese families. Typically, two generations including couple and their parents or child(ren) live together. Both them have their own bedroom and share the other rooms at the same time. Living room is used as a place for family entertainment. Watching TV is the most common enjoyment for Chinese families. Bedroom is used mainly for sleeping and storage. In some comparatively small housing units, the living room and kitchen are combined. In these cases, the usage of the combined space has similar characteristics with it in Group two housing units. The combined space is apt to be used in various ways. A total of 65 samples were acquired in the survey.



Figure 4-15 Room usage in G3-01

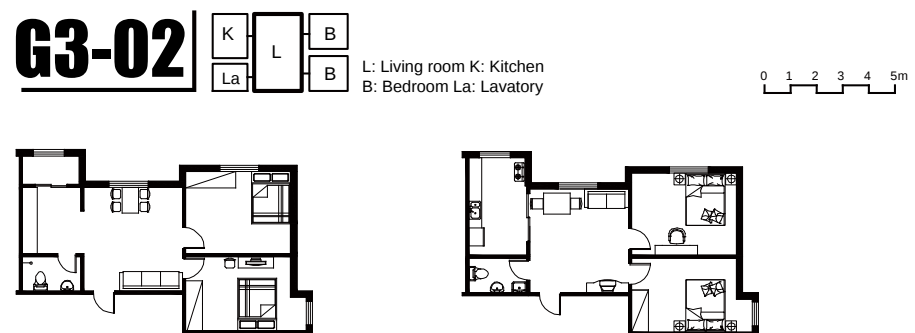


Figure 4-16 Room usage in G3-02



Figure 4-17 Room usage in G3-03

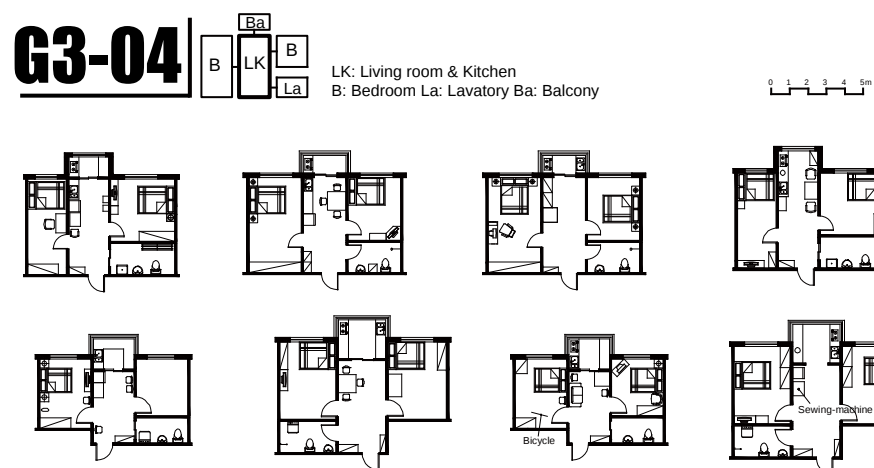


Figure 4-18 Room usage in G3-04



Figure 4-19 Room usage in G3-05

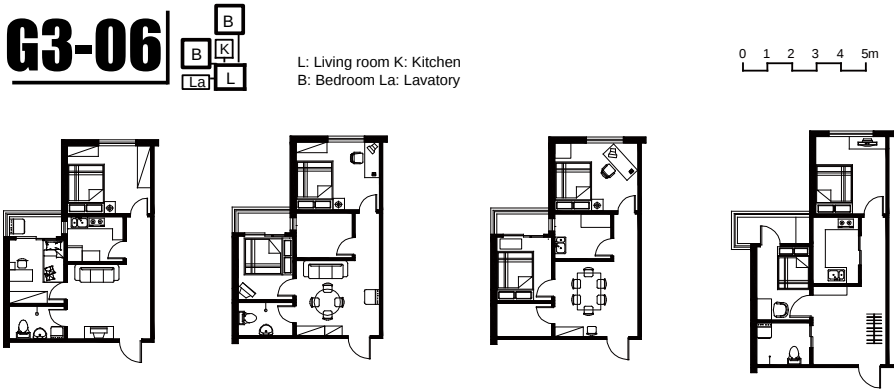


Figure 4-20 Room usage in G3-06

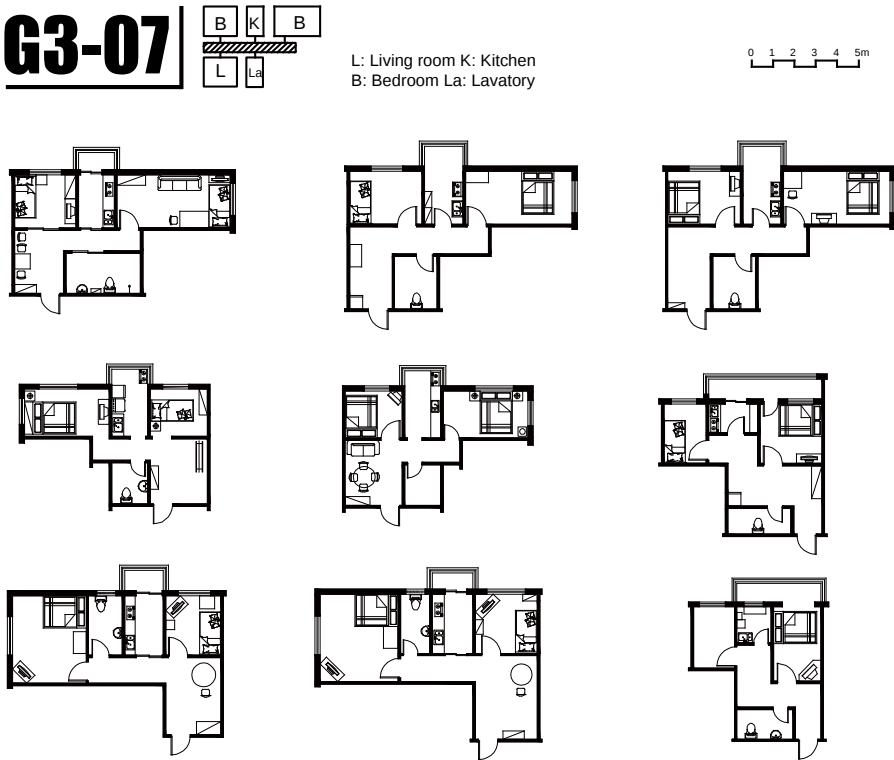


Figure 4-21 Room usage in G3-07

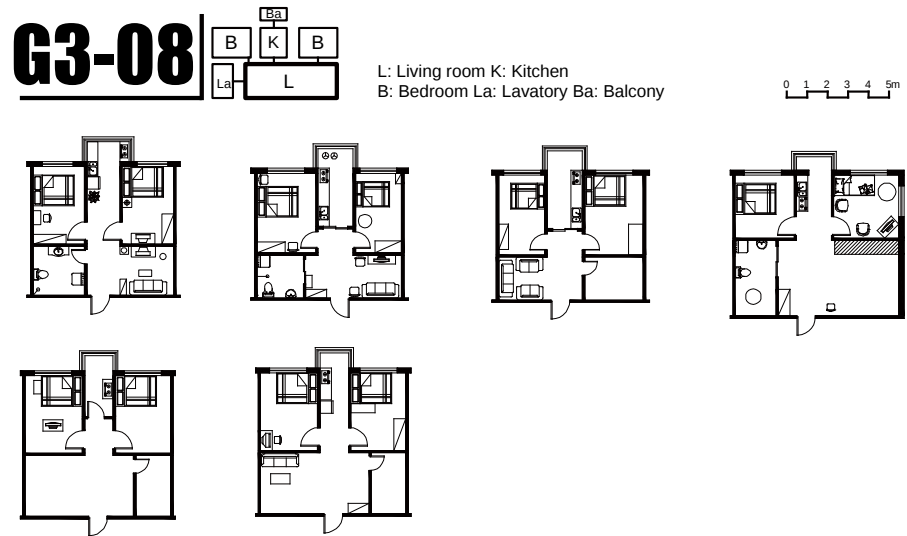


Figure 4-22 Room usage in G3-08

4.2.4 Two-bedroom housing units (ii)

Just three samples are available in this group. This indicates that two bedroom meet the needs of most families. In the three housing units, one family placed an additional bed at the dining space. The other two families placed the bed in the living room, same with those in Group two (Figure 4-23).

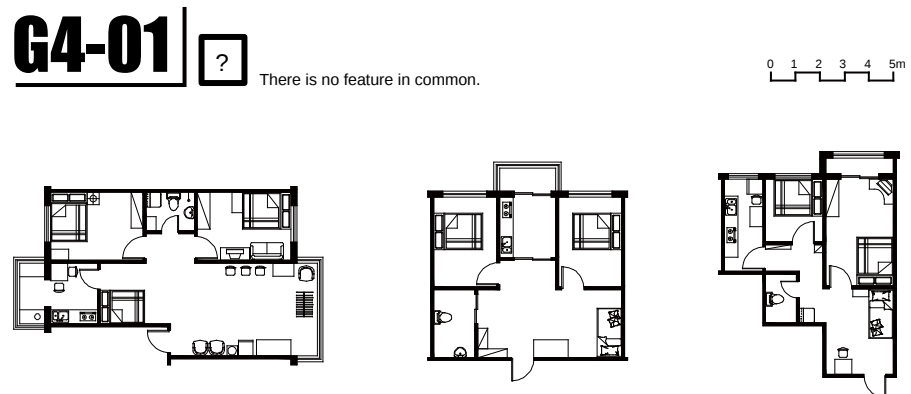


Figure 4-23 Room usage in G4-01

4.2.5 Remodeled housing units

A noticeable point of the room usage in the six projects is that remodeling is very common. Around 30% (80/268) of the surveyed housing units had been remodeled. The original floor plans of these units are showed in Figure 4-24. This implies that the original floor

plans are questionable in many cases. According to the floor plans I got, the reasons for remodeling could be summarized as:

- (1) To separate one more bedroom (n=16);
- (2) To separate a space as kitchen (n=7);
- (3) To combine the living room with kitchen for a wider space (n=22);
- (4) To combine the kitchen with balcony for a wider kitchen (n=16);
- (5) To enlarge the living room by remodel the inner walls (n=14);
- (6) Other reasons (n=5).

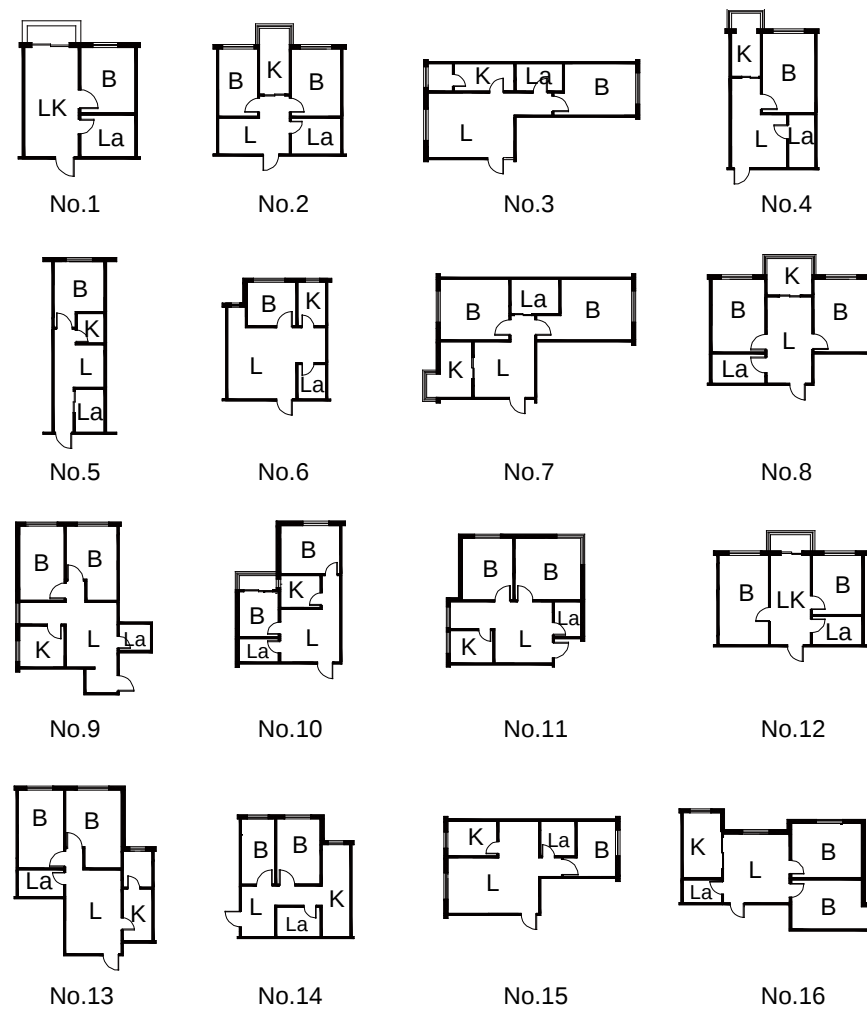


Figure 4-24 Original plans of the remodeled units. L: living room, B: bedroom, K: kitchen, La: lavatory, LK: living room & kitchen

To separate one more bedroom

This is another strategy the residents adopted to accommodate all their family members. Some of them simply put an additional bed in the living room as I showed in the preceding subsection. This will lead to a problem about personal privacy. Family members who sleep in the living room will lose their privacy, since the living room is a relatively common space in one housing unit. To resolve the problem, some residents install a partition at the



Figure 4-25 Remodeled floor plans to separate a bedroom. Refer to Figure 4-24 for the original plans.

living room to separate a bedroom. The partitions are of ground glass in general. It could not only protect the privacy of people sleeping in the living room, but also could reduce the influence of the partition on the natural lighting in the living room. However, it still has impact on the quality of the living room, which has been proved a primary factor that will influence residents' satisfaction. Another reason for this situation is that the household composition has not been taken into consideration when governments distribute the public housing units.

To separate a space for kitchen

Different families have different preferences on floor plan. In some original floor plans, kitchen is combined with living room. However, it cannot satisfy part of residents. They prefer a kitchen which is separate from other rooms. According to the residents, Chinese cooking style will generate much of smoke which is harmful for human health. Also, if the kitchen is open, the interior spaces will be full of the smell of cooking. This will also have bad influence on the interior air quality. A sliding door equipped in an additional wall is the widely used approach to achieve the purpose.

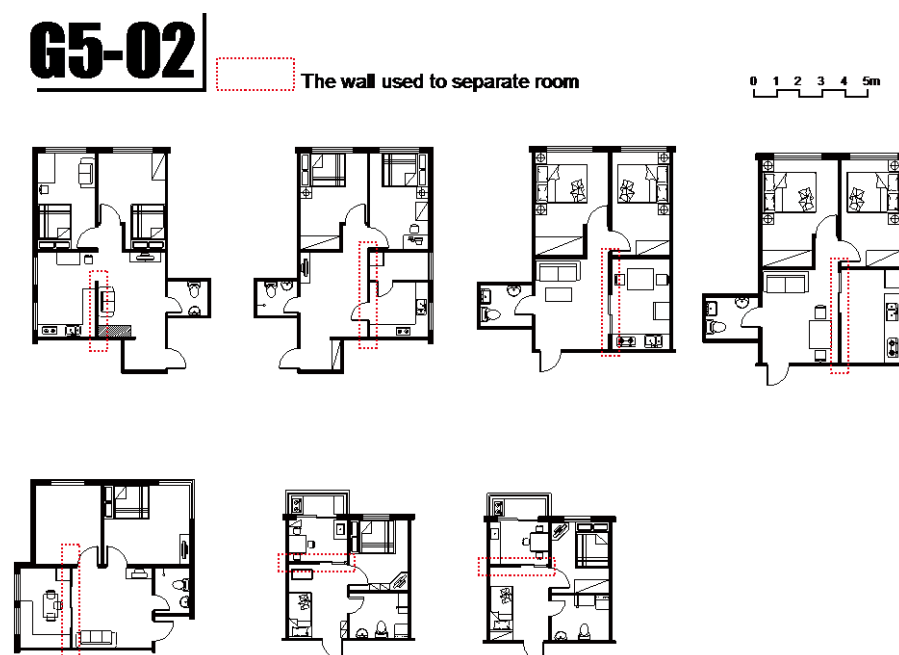


Figure 4-26 Remodeled floor plans to separate a kitchen. Refer to Figure 4-24 for the original plans.

To combine the living room with kitchen for a wider space

This aim is somewhat opposite to the preceding one. The main considerations of this strategy are that it can improve the natural lighting in the living room and a wider space could be use flexibly. Ventilation is another consideration. If a wall is built between living room and kitchen, the ventilation might be poor. Eliminate



Figure 4-27 Remodeled floor plans to combine living room and kitchen. Refer to Figure 4-24 for the original plans.

the obstacles between the living room and the kitchen would improve the situation.

To combine the kitchen with balcony for a wider kitchen

In the original floor plans of some housing units, a balcony is designed next to the kitchen for storage. However, many residents combine the kitchen and the balcony to get a wider kitchen. According to the residents, the reasons why they remodel in this way are to improve the ventilation in the kitchen and get more storage space. The balcony is a kind of obstacle to emit the cooking smoke. Combining the kitchen and the balcony is the most popular way to resolve this problem.



Figure 4-28 Remodeled floor plans to combine kitchen and balcony. Refer to Figure 4-24 for the original plans.

To enlarge the living room

In Chapter 3, I concluded that living room is the unit feature which needs to be improved pressingly. It is positively related to residents' satisfaction, but was considered bad by many respondents. In this group of floor plans, residents remodel the floor plan to enlarge the living room. Some of the remodeling aims to improve the natural lighting and ventilation in the living room. To enlarge the living room, the positions of inner walls are changed in some units (Figure 4-29). To improve the natural lighting and ventilation in the living room, new windows are put in the inner walls and some residents just simply demolish the inner walls. The remodeling is dangerous at times and is prohibited



Figure 4-29 Remodeled floor plans to enlarge living room. Refer to Figure 4-24 for the original plans.

according to the current regulations on home modification. This reflects residents' desire for a better interior environment to a certain extent.

The others

There are five floor plans remodeled based on different consideration from the preceding purposes. Two families relocate the inner wall to get a corner space. One family use the new space for storage and the other one just leave it vacant. The third family combines the bedroom and the balcony. The forth family relocate the inner wall to enlarge the bedroom. After the remodeling, there is no living room in this unit. The last family builds a door at the balcony for an easy access to out, since their unit located on the first floor.

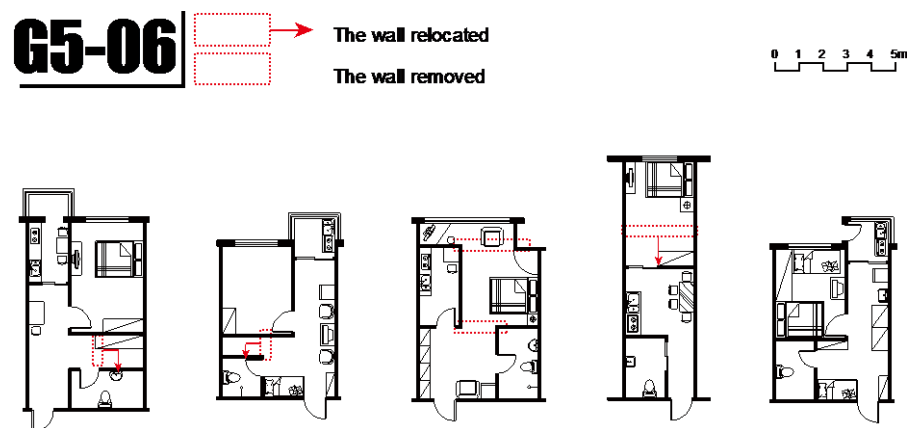


Figure 4-30 Remodeled floor plans for different purposes

4.3 Room Usage of the Elderly and Disabled

The second survey we conducted is about the room usage of the elderly and disabled living in the public housing units. In this survey, some of the shortcomings in the first one are amended, such as the dimensions with low accuracy. A total of 101 floor plans were obtained. In the survey, the surveyors are required to measure the dimensions of main furniture and room sizes. The floor plans therefore could be more believable. To be comparable with the data of the first survey, the interior layout data in this survey is classified into five groups (G1*-G5*), similar with it in

the first survey.

4.3.1 One-bedroom housing units (i) (2nd survey)

There are 14 samples in this group. Generally speaking, the room usage in this group of family is similar with it in the first survey. The interior environment is poor for the same reasons I presented in the preceding section. The family types in this group are single elderly people and elderly couple. Another point of similarity to it in the first survey is that residents prefer using the balcony as a place for cooking. However, there are several differences worth being mentioned. The elderly people like storing sundries in their home and do not want to throw them away. Thus, they need more storage space in their housing units. Nevertheless, few storage spaces are available when they moved in, which make the interior are mess several months later. Kitchen, balcony and bedroom are their primary choices for storage. Another point of difference with the first survey result is that a family ran a home business in their housing unit. That makes the interior layout extremely different with the others (Figure 4-31). It is seldom seen in the survey but do have. In some special cases, it might also have impact on the daily life of the residents.



Figure 4-31 Room usage in G1*

4.3.2 **One-bedroom housing units (ii) (2nd survey)**

Similarly, the room usage in this group is not that distinguished with it in the first survey. The main features of the room usage could be summarized as: (1) sundries in each room makes the interiors mess, since there is no enough storage space; (2) the residents would place an additional bed in the living room. In some big family, the additional bed might be placed in the kitchen and the balcony is used as a small kitchen.

Housing Unit Typologies Based on Room Usage

G2*

L: Living room K: Kitchen LK: Living room & Kitchen
B: Bedroom La: Lavatory Ba: Balcony

0 1 2 3 4 5m



Figure 4-32 Room usage in G2*

4.3.3 Two-bedroom housing units (i) (2nd survey)

There are 43 floor plans could be classified into this group. Generally, two bedrooms can satisfy the most of residents. It is still common that using the balcony as a small kitchen to save space for the living room. If there is old couple in one family, the old couple prefers sleeping separately. Two singles beds are arranged in one bedroom in some of these families. Another mentionable point is that some items which commonly should be placed out are moved into the interior, such as bicycle. In some families, the living room is too small to be used appropriately. Additionally, the bedroom is relatively wider. In this case, the residents might use the bedroom as the living room. Furniture, such as sofa and television set, are placed in the bedroom. The living room simply becomes a storage space.



Figure 4-33 Room usage in G3*-01

G3*-02

L: Living room K: Kitchen LK: Living room & Kitchen
B: Bedroom La: Lavatory Ba: Balcony

0 1 2 3 4 5m

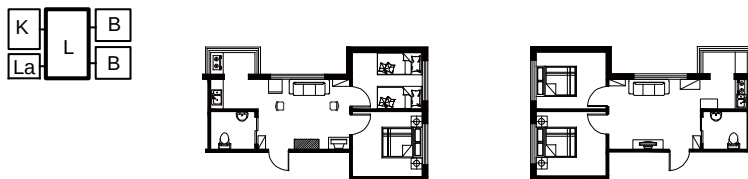
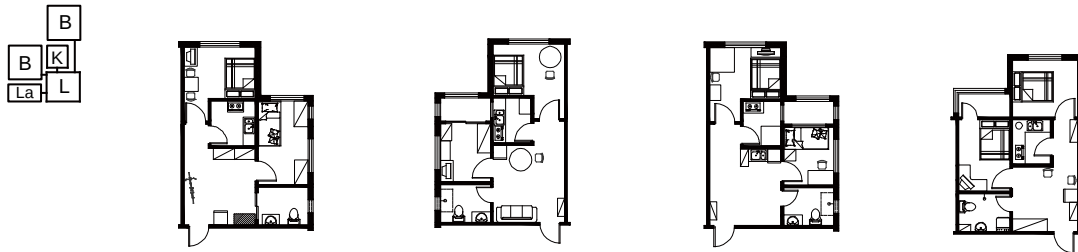
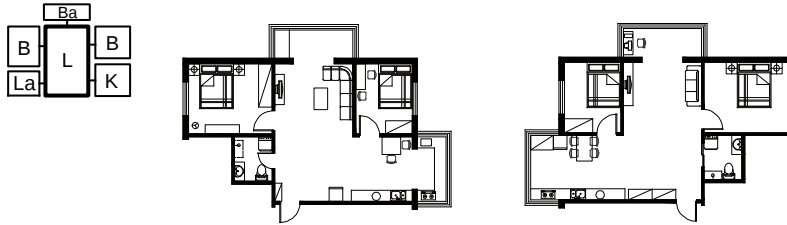
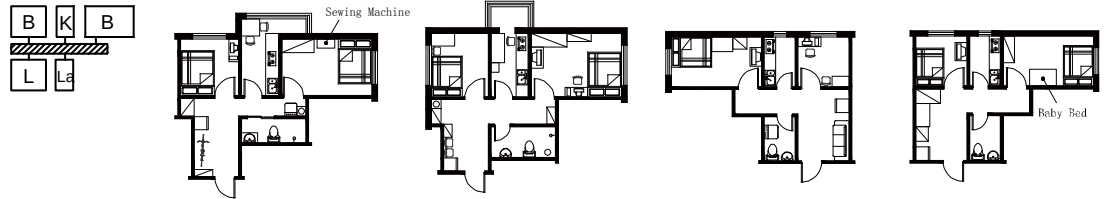


Figure 4-34 Room usage in G3*-02



Figure 4-35 Room usage in G3*-03

4.3.4 Two-bedroom housing units (ii) (2nd survey)

Only one two-bedroom housing unit is included in this group. The residents place an additional bed in the living room, which is similar with what the big families had done in the first survey (Figure 4-36).

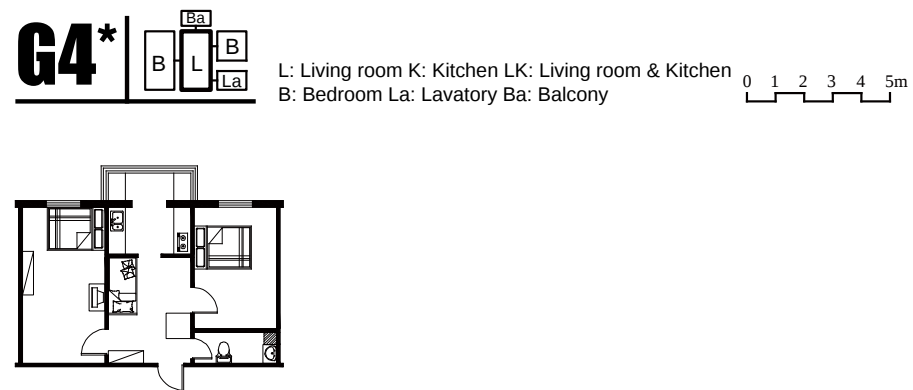


Figure 4-36 Room usage in G4*

4.3.5 Remodeled housing units (2nd survey)

In the second survey, housing remodeling is still common. A total of 21 families remodeled the interiors. According to the purposes of the remodeling, these floor plans could be divided into four groups. Generally, the purposes of remodeling in this survey are similar with them in the first survey. Since the sample size is smaller, I try to make the classification more generally to avoid the circumstance that only one or two floor plans in one group. Taking the classification standard in the first survey as a reference, the purposes of remodeling in the second survey could be concluded as:

- (1) To separate one more room. The room might be a separate bedroom, a separate kitchen or a storage room (n=9).
- (2) To enlarge the size of the living room (n=6).
- (3) To merge two rooms to improve the natural lighting in the living room (n=3).
- (4) The others (n=3).

To separate one more room

In general, the newly separated room is used as the bedroom in most families. Only two families have different purposes, in which one is to separate a storage space for the kitchen and one is to separate a storage space (Figure 4-37).

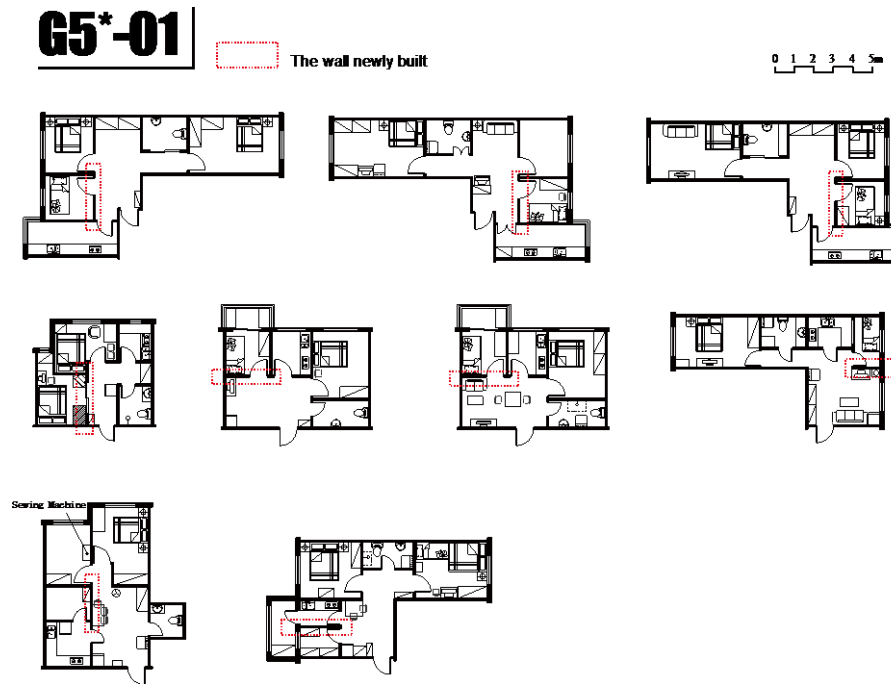


Figure 4-37 Room usage in G5*-01

To enlarge the size of the living room

Enlarging the size of the living room is achieved by removing or relocating some inner walls. It is prohibited by the current local regulations, but very common in the public housing (Figure 4-38).

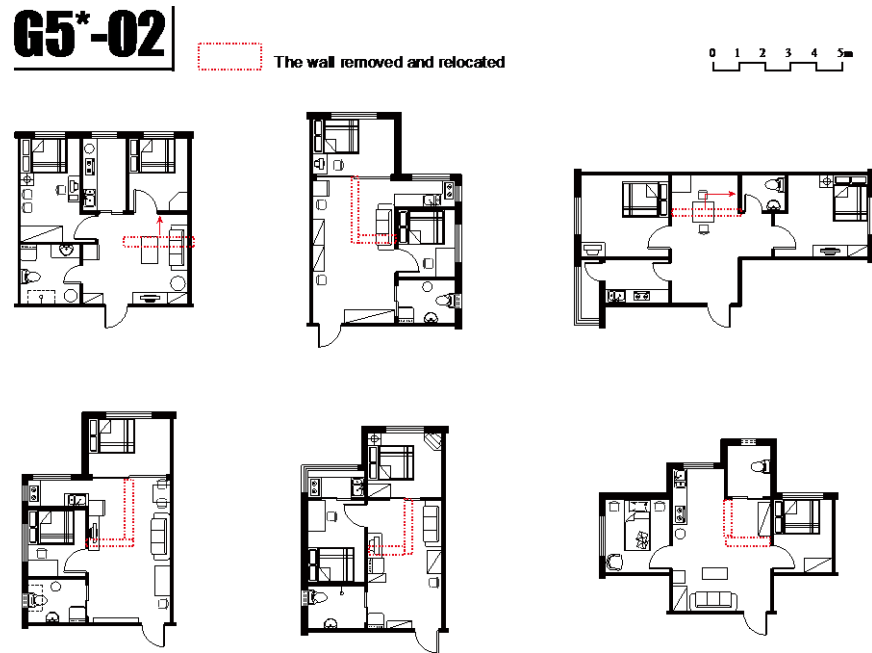


Figure 4-38 Room usage in G5*-02

To merge two rooms to improve the natural lighting in the living room

In some housing units, the living rooms have no window. Therefore, the natural lighting is very poor. To improve the situation, two families remove the wall between the kitchen and the living room; one family removed the wall between the bedroom and the living room (Figure 4-39).

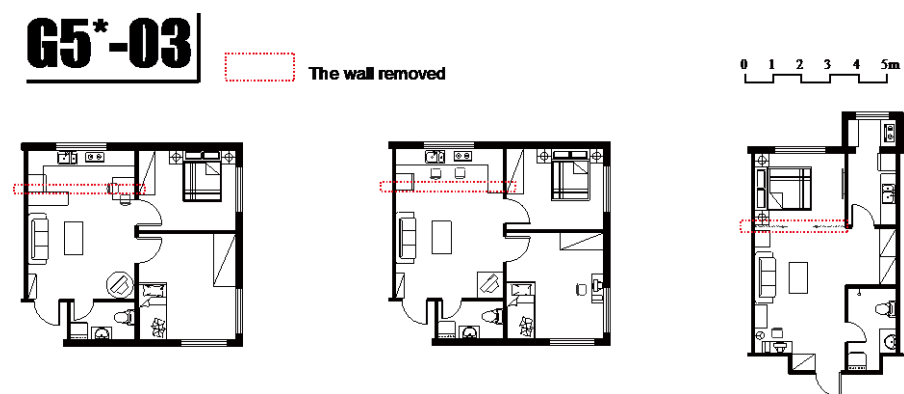


Figure 4-39 Room usage in G5*-03

The others

Some remodeling could not be classified into the above three groups. These housing units are presented in Figure 4-40. The

residents in unit (i) changed the location of the door of kitchen from the place near to the entry to the other side. The remodeling of unit (ii) is to enlarge the size of kitchen and lavatory. A three generation family is living in unit (iii), including a couple and their parent (79 and 83 years old respectively) and child. For this family, more bedrooms are desired. Hence, the remodeling focuses on how to separate more bedrooms in the unit.

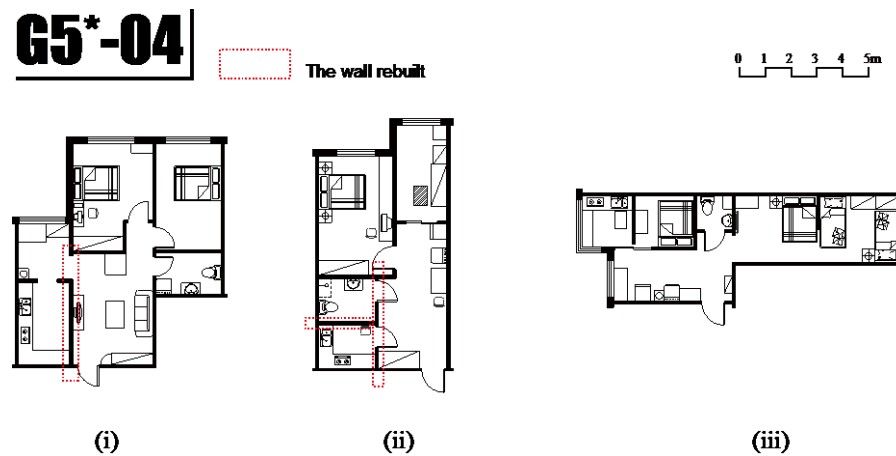


Figure 4-40 Room usage in G5*-04

4.4 Discussion about the Room Usage and Remodeling Pattern

In the two surveys, a total of 369 floor plans were acquired. Generally, the floor plans are classified into two styles, LK style and L&K style. LK style refers those floor plans, in which the living room and kitchen are in a same space. L&K style represents those floor plans, in which the living room and kitchen are separated. According to the sizes of living room and bedroom, the L&K style floor plans are farther divided into two types. One type of floor plans has a wider living room than bedroom; another one has a living room and a bedroom, which have similar dimensions. Additionally, the family composition will also affect the room usage. Thus, one generation family and multiple generation family are discussed individually. All room usage patterns are presented in Figure 4-41.

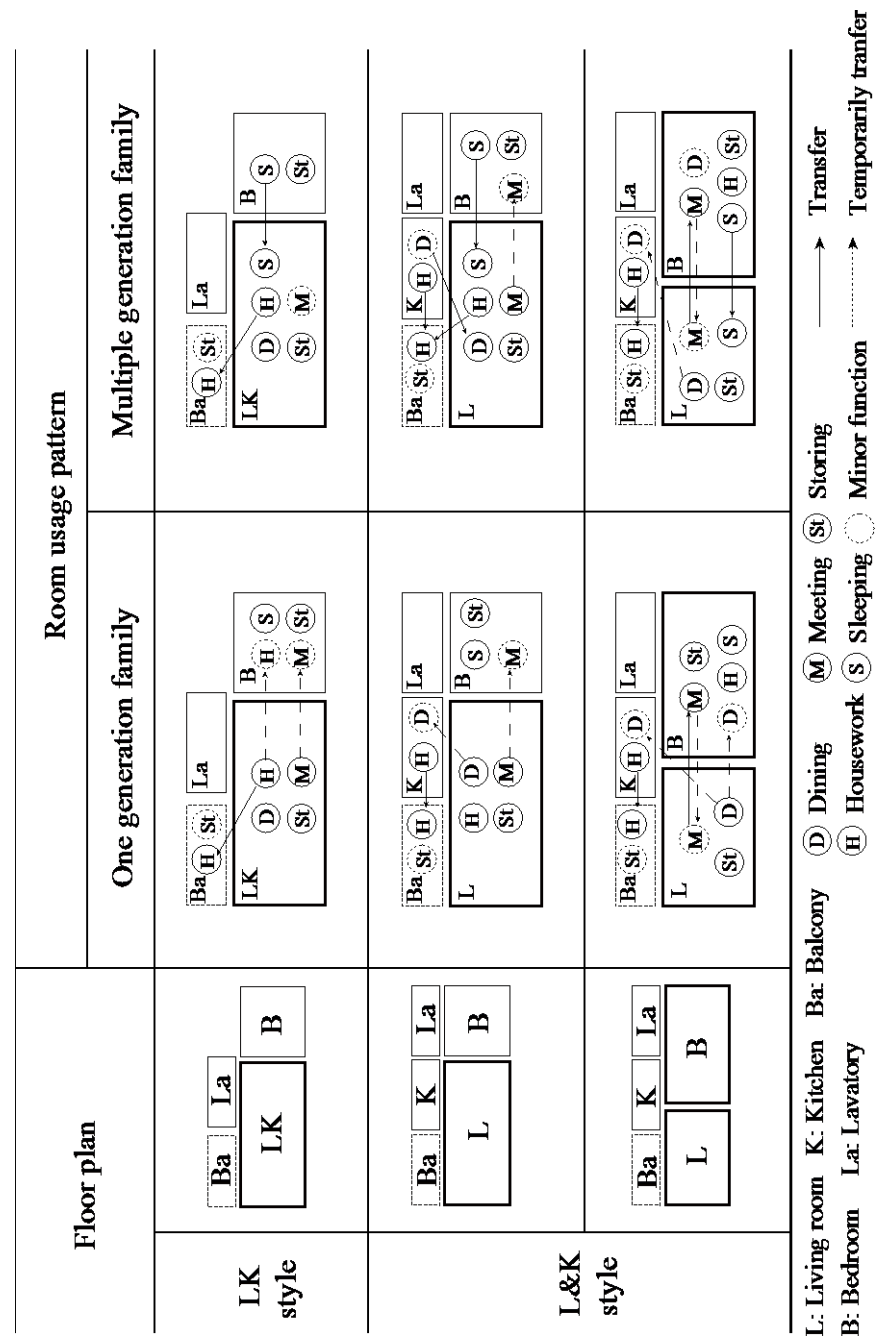


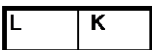
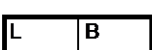
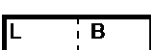
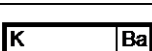
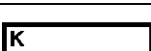
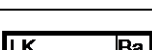
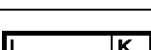
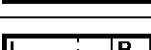
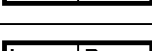
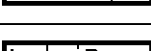
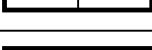
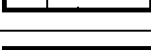
Figure 4-41 Room usage patterns

Each room in different room usage pattern serves different functions. The functions may be transferred to other rooms. The transfer will be more common if the living room is not separate or the size of living room is too limited. There are two features of room usage need to be emphasized. The first one is that no matter the floor plan is, the LK and L will be used as a place for sleeping in multiple generation families. Another one is that if the bedroom size is larger than the living room size, most of functions of living room will be transferred to bedroom.

Remodeling is very common in our survey. Residents will remodel the interiors according to their special needs. Generally speaking, there are three main purposes of their remodeling. They are to separate one more room, the new room might be bedroom or kitchen; to merge two rooms, living room with kitchen or bedroom, kitchen with balcony; to enlarge one room, the room might be living room, bedroom or kitchen and lavatory. In terms of quantity, most of remodeling focus on separating a room as bedroom, merging living room and kitchen together or merging kitchen and balcony together, enlarging the living room. Figure 4-42 shows the purposes of residents' remodeling. A total of 101 floor plans are remodeled, namely 27.4% of the floor plans are remodeled. It must be paid more attention in the future public housing design.

There is no great differences could be found between the room usage of the elderly and the general. One mentionable point is that the old couple prefers to sleep separately, which implies that the bedroom should accommodate two single beds at least to fulfil their demand on this. In addition, the old people apt to store more foods and things for emergence. Therefore, more accessible storage spaces are very important for them.

Housing Unit Typologies Based on Room Usage

Purposes		Remodeling		N
		Original	Remodeled	
To separate	Bedroom	LK 	LK B 	7
		L 	L B 	16
	Kitchen	L 	L K 	8
To merge	Living room & Kitchen	L K 	LK 	24
	Living room & Bedroom	L B 	L B 	1
	Kitchen & Balcony	K Ba 	K 	16
To enlarge	Living room	LK Ba 	L K 	2
		L B 	L B 	18
	Bedroom	L B 	L B 	1
	Kitchen & Lavatory	K L 	K L 	1
Others				7
			Total	101

L: Living room B: Bedroom K: Kitchen LK: Living room & Kitchen Ba: Balcony La: Lavatory

Figure 4-42 Public housing remodeling pattern

4.5 Detailed Discussion on Room Usage in Low-rent Housing

4.5.1 Data source and main results

Data used in this section comes from a certain part of the first survey data introduced in the previous chapter. The foci of this section are the two low-rent housing projects, *Anmin* and *Xianggongbei*. There are 97 questionnaires answered by the tenants in the two projects, and 73 floor plans are obtained. In addition, the pictures of the interior room arrangement were taken if we obtained the tenants' permission. These floor plans are classified into different categories according to the household type and room

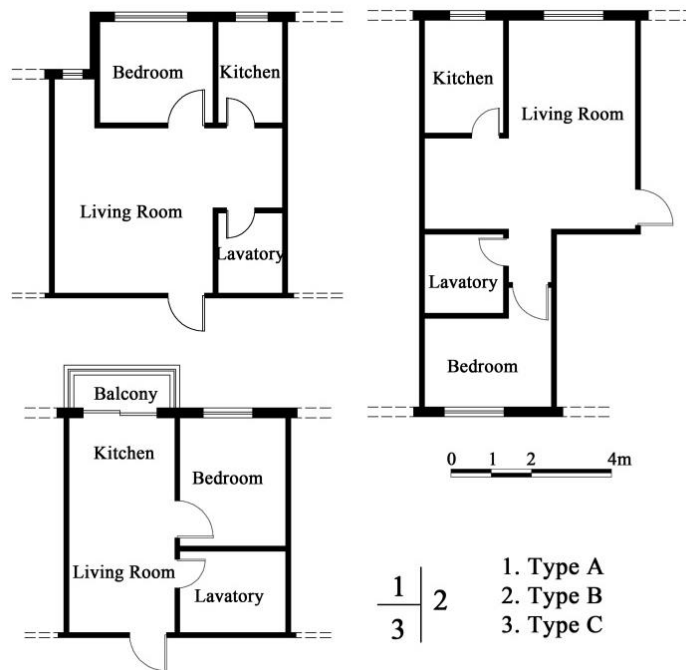


Figure 4-43 Basic floor plans

usage. Then I explored their room usage patterns and actual environment needs in detail.

According to the survey, the floor plans could be classified into three different types, namely, Type A, Type B and Type C (Figure 4-43). Eleven, 29, and 33 floor plans were collected respectively in the survey. Type A and Type B units had a separate living room, bedroom, kitchen and lavatory, while a combined space was provided in Type C units instead of a separate living room and kitchen. Only one bedroom was available in all three types. The living areas of Type A, B, C were approximately 46 m², 51 m² and 43m² respectively. The average age of tenants living in Type A units was much older than those living in Type B and Type C, 55% of householders were older than 60 (Figure 4-44). Sixty-four percent of families had one or two old people in the Type A units (Figure 4-45). The tenants who are living in Type B and C units were younger. One-generation households and two-generation households were more common in low-rent housing (Figure 4-46). Only 12% of households living in Type C units are three-generation households. The majority of interviewed families have three family members or fewer (Figure 4-47). In Type C units, there were some big families which have even six family members.

Housing Unit Typologies Based on Room Usage

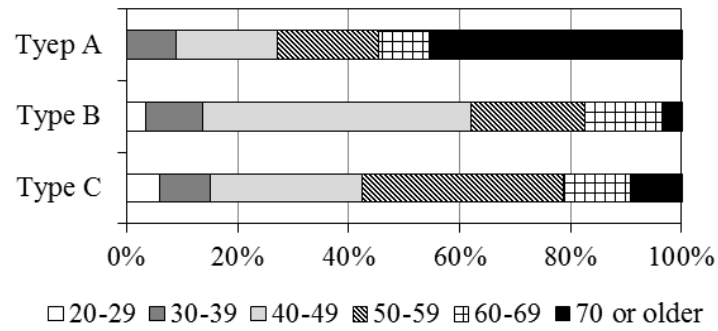


Figure 4-44 Age of the householder

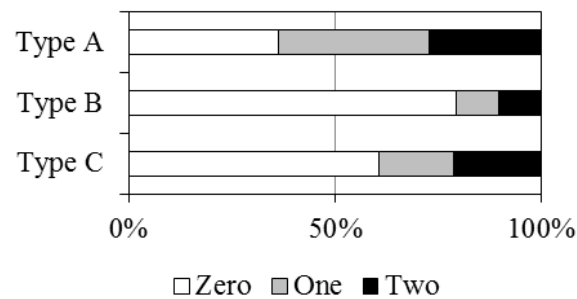


Figure 4-45 Number of senior people in one family

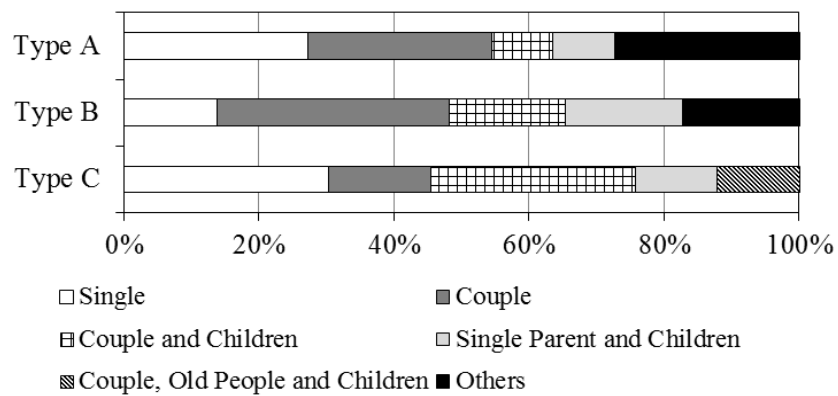


Figure 4-46 Family types

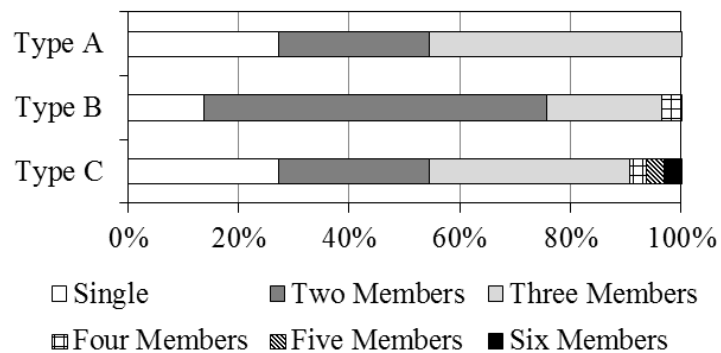
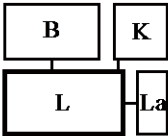
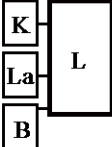
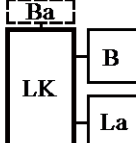
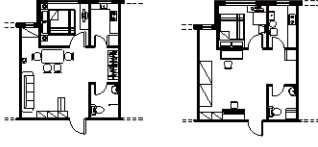
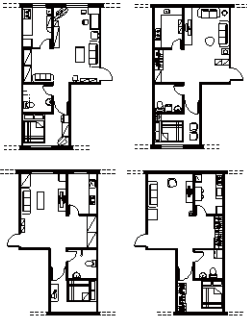
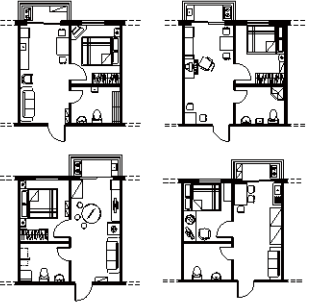
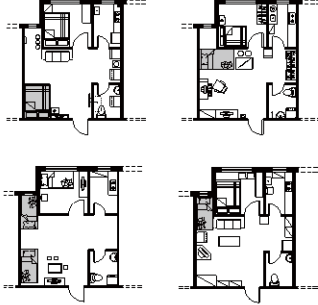
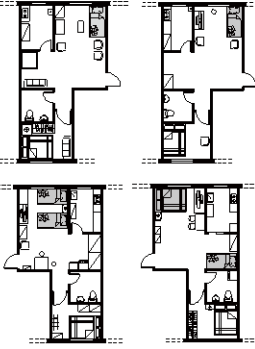
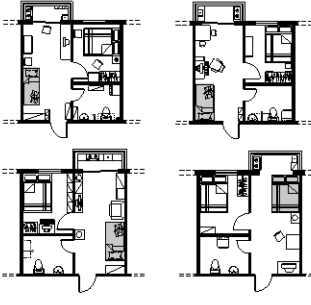
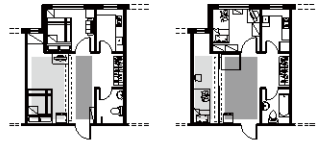
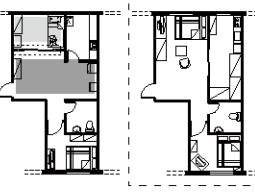
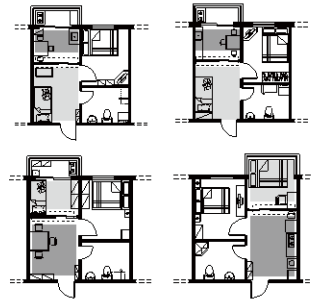


Figure 4-47 Family size

4.5.2 Room usage classification

To meet their various actual needs in daily life, inhabitants of low-rent housing changed the function of some rooms or even modified the original plan. This caused very different room usage approaches, which is the focus of this section. After reviewing all of the floor plans we obtained from the survey, we found they could be classified into nine different groups according to the family types and basic floor plan. Generally, single generation families just need one bedroom, multi-generation families need more bedrooms to accommodate all the family members. But, only one bedroom is available in low-rent housing, so they have to change the room arrangement to spare space for one or two additional beds, and that is an important reason which leads to the differences in room usage pattern. Moreover, part of the tenants divided the living room into two spaces by a makeshift glass partition to separate one more private room. That is another characteristic we found from the survey. Figure 4-48 shows the housing unit usage in these nine groups. According to the description from the tenants, even the basic decorations had not been provided when they moved in. Some tenants decorated the interior by themselves, while more tenants decided to leave it in its original condition and just simply furnished the house to avoid extra expenses and save time. Thus, the interior environment in a majority of low-rent housing was poor and varied in each housing unit.

Housing Unit Typologies Based on Room Usage

	Type A (building area: 46 m ²)	Type B (building area: 51 m ²)	Type C (building area: 43 m ²)
	 B: bedroom L: living room K: kitchen La: lavatory	 B: bedroom L: living room K: kitchen La: lavatory	 B: bedroom LK: living room & kitchen La: lavatory Ba: balcony
One Generation Family			
	The major activities: B: ①③⑥⑧ L: ①②③④⑧ K: ⑤⑧ La: ⑦⑨		B: ①⑥⑧ LK: ①②③④⑤⑧ Ba: ⑤⑧ La: ⑦⑨
Multiple Generation Family (i) (no partition)			
	The major activities: B: ①③⑥⑧⑨ L: ①②③④⑥⑧⑨ K: ⑤⑧ La: ⑦⑨		B: ①⑥⑧ LK: ①②③④⑤⑥⑧ Ba: ⑤⑧ La: ⑦⑨
Multiple Generation Family (ii) (a partition was built in living room)	  Partition  Space for sleeping  Space for storage, cooking or dining	 One wall was demolished to enlarge the kitchen. The increased space in kitchen was used for storage.	
	The major activities: B: ①③⑥⑧ K: ⑤⑧ L: ①②③④⑥⑧⑨ La: ⑦⑨		B: ①⑥⑧ LK: ①②③④⑤⑥⑧ Ba: ⑤⑧ La: ⑦⑨

(Major home activities: 1.recreation; 2. meeting; 3. studying; 4. dining; 5. cooking and dish washing; 6. sleeping; 7. taking shower; 8. storing; 9. clothes washing and airing.)

Figure 4-48 Room usage classification and typical examples

These three basic floor plans were different from each other and had their own characteristics. Type A units had an irregular living room, compared to Type B and Type C units. An awkward corner space was designed in the living room beside the bedroom. Although the original consideration of designers was hard to know, it was questionable in fact according to the actual usage (we will discuss this point later). The profile of Type B units as well as the shape of the living room resembled the letter “L”. It differed from Type A and Type C units, in which both south and north sections of the unit could obtain natural lighting. The living room in Type B was the widest among these three types. Both Type A and Type B had a separate living room, bedroom, kitchen and lavatory, while Type C units provided a combined space instead of a separate living room and kitchen. A balcony was available in Type C units, but the majority of tenants converted this balcony to a place for cooking. The bedroom and the lavatory had the largest space in Type C units, compared with Type A and Type B units.

As mentioned above, the family type greatly affects the room arrangement. There was a huge difference found between the one-generation family and multi-generation family with respect to their room usage. In general, one bedroom was provided in low-rent housing and was enough for a one-generation family. One-generation families living in Type A units cannot use the living room efficiently due to its irregular shape. The corner space was used as storage or just left vacant. The tenants didn’t have a specific idea on how to furnish the living room and just simply arranged the furniture along the wall. The living room arrangements of one-generation families in Type B units were more sensible. The television and sofa were placed at either side of the living room and at an appropriate distance apart. The space between the kitchen and lavatory was used for storage, in general. Most one-generation families in Type C units arranged their furniture along the wall and used the other side of the combined

space as a space for dining. A cooking space had been set up on the balcony in many Type C units. The multiple generation family used their rooms in many different ways. The room arrangement of multi-generation families was further classified into two groups as shown in Figure 4-48. The multi-generation families (i) placed one or two extra beds in the living room, which occupied a lot of space. In Type A and Type B units, generally the extra beds were placed in the corner of the living room. In Type C units, the extra beds were placed in the combined space, close to the entrance door or deep in the space. The multi-generation family (ii) converted the floor plan by building a partition in the living room or demolishing some walls (although it is prohibited). Partitions were very common in Type C units. The living room was divided into two parts, one was used as a private bedroom and the rest of the space was used for storage, dining or cooking. One family in a Type B unit demolished the wall between the kitchen and the living room to enlarge the space in the kitchen. The increased space was used for storage (Figure 4-48).

4.5.3 Comprehensive assessment of different rooms

According to the information collected from the questionnaire survey and face-to-face interview, family type influenced the room usage greatly. As you can see from Figure 4-48, the low-rent housing households were classified into nine groups based on different family type and basic floor plan. In this section, data concerning how each room impacted the family's living experience are explored. There were 30 questionnaires collected from one-generation families and 43 questionnaires from multi-generation families in which eight families belong to the group of multi-generation families (ii). The results indicated that multi-generation families gave a worse assessment of their living room, compared with the one-generation families, especially multi-generation family (ii) who changed the floor plan by themselves (Figure 4-49). Thirty-seven percent (16/43) of the

multi-generation families considered their living room bad, for one-generation families, this proportion was 30% (9/30). There was no significant difference on the assessment of the bedroom in these three groups (Figure 4-50). Twenty-six percent (11/43) of multi-generation families gave “bad” assessments of their kitchens, while just 13% (4/30) of one-generation families considered their kitchen bad (Figure 4-51). The results of the assessment of the lavatory were similar to that of the bedroom, no significant difference was found between the one-generation family and the average of multi-generation family; but group (ii) of multi-generation families was not so satisfied with the lavatory compared with group (i) (Figure 4-52).

Generally, the majority of families were satisfied with their houses. The multi-generation families were not as satisfied with their living room and kitchen as one-generation families.

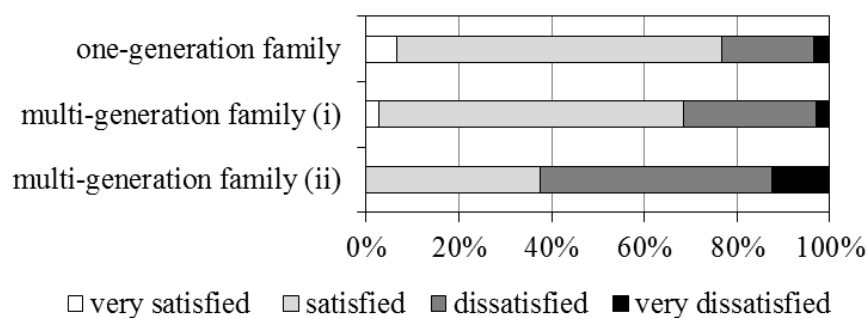


Figure 4-49 Residents' assessment of living room

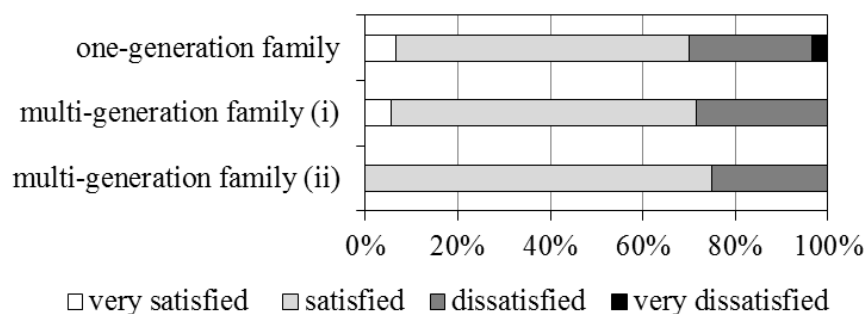


Figure 4-50 Residents' assessment of bedroom

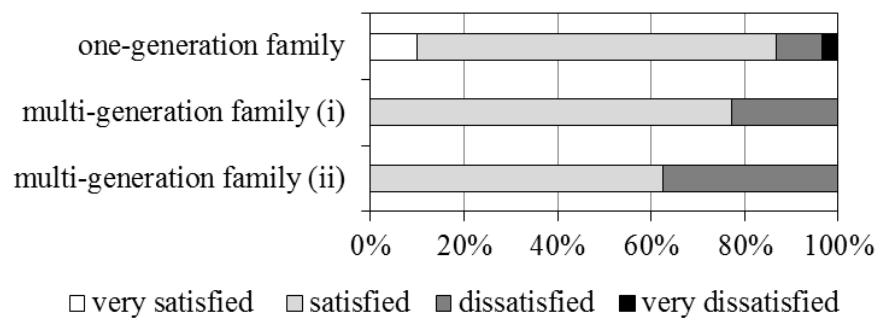


Figure 4-51 Residents' assessment of kitchen

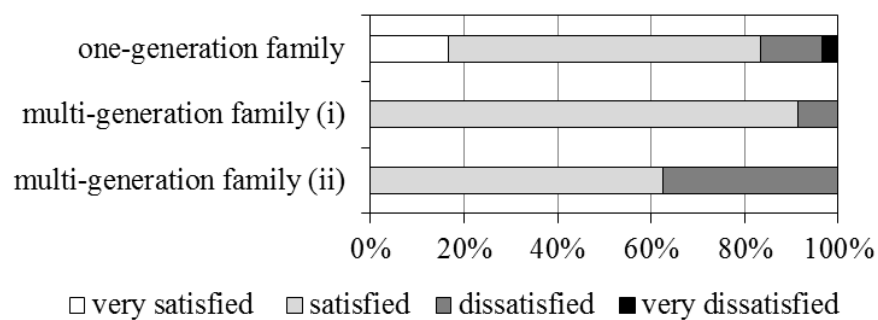


Figure 4-52 Residents' assessment of lavatory

4.5.4 Discussion

According to the results of questionnaire survey, one important point was the variety of family type. Firstly, the aging population problem in low-rent housing was more serious, compared with the average level of Shenyang city. The latest data indicated that the proportion of senior citizens was 17.1% in this city², while the proportion in low-rent housing we investigated was 27% (39/145). Thirty-six percent of interviewed families had one or two senior people. Hence, the low-rent housing designs must give high priority to the needs of seniors. Secondly, multi-generation family was very common in low-rent housing. Fifty-nine percent (43/73) of interviewed families were multi-generation family. One bedroom is apparently inadequate for them.

As far as the floor plan was concerned, regular interior space was easier to be used efficiently. In Type A units, the corner space

beside the bedroom became the focus of tenants' complaints. The tenants didn't know how to properly deal with this corner space. Some multi-generation families placed one bed in the corner and one-generation families just used it as a storage place or left it vacant. The interior spaces in Type B and Type C units were relatively regular and easy to furnish. The space in living room of Type B units was wider than the other two types of units and was considered satisfactory by the tenants. According to Figure 4-34, the usage of the living room varied depending on the family type. More space was required to accommodate the furniture, to support diverse family activities, and to serve other functions. Hence, housing designers need to address how to enlarge the living room area in low-rent housing units. By contrast, the space in the bedroom wasn't really needed. Furniture like a wardrobe and table (that a majority of people thought should be put in the bedroom) were placed in the living room intentionally. One reason given by the tenants was that there wasn't enough space in the bedroom, and the other important reason was the bedroom was considered just a space for sleeping; so, other activities could be done elsewhere. Consequently, reducing the space in the bedroom and enlarging the living room area are recommended based on the premise that providing enough space for sleeping in the bedroom, according to the tenants. The tenants were not so satisfied with the combined space in Type C units. They preferred a separate kitchen and living room, and using the balcony as a kitchen provided a good proof of this assumption. The makeshift partition in the combined space also indicated their desire for separate living rooms.



Figure 4-53 Low-rent housing interiors. 1. A living room with partition 2. An extra bed was placed in living room 3. Bad environment in lavatory

Regarding the room usage, how the living room was used varied greatly across the nine groups. It served multi-functions: as a meeting place, a dining place and a place for recreation. For multi-generation families, the living room is also a sleeping area. However, the living rooms in these units are considered public spaces; therefore, this infringes on the privacy of people sleeping in the living room. To protect their privacy, some tenants built a partition in the living room to create a private bedroom (Figure 4-53). Usually, the partition was of glass and provided poor insulation against sound and cold. As families change in size, there is a chance of converting the partition to meet the new needs of tenants. But this will take extra money and time; an inconvenience they try to avoid. This also reflects the tenants' desire for flexibility of the floor plan in low-rent housing. Basically, the bedroom usage was similar in these three types of units. The bed occupied much space in the bedroom, and the rest of the space can only hold some small furniture. The kitchen and lavatory were considered minor spaces by the tenants. No artificial air exchange facilities were available when they moved in. This created a very bad interior environment (Figure 4-53). Many items like buckets and basins were placed on the ground because there is no storage space in the lavatory. Some lavatories were filled with a strong smell. The kitchen had a similar situation as the lavatory. However, the tenants didn't consider it to be the main issue according to our survey. The

level of tenants' satisfaction with the kitchen and lavatory was higher than that of the living room and bedroom. Although it really needs to be carefully designed from the perspective of researchers, the tenants think it is defective, but acceptable.

An extensive public housing provision has made low-income groups believe their accommodation will be provided in the near future. While the staggering demand for public housing provision has centered policy makers' and designers' attention, and the counsel from the current residents was totally neglected. Against this background, our review of the housing unit usage of public housing residents will provide useful guidance for future public housing design and meaningful for improving the living experience of tenants.

4.6 Conclusions

This review of living experiences of low-rent housing tenants provided valuable information about what kind of interior space the tenants' desire. The defective floor plan and interior environment made the low-rent housing more like a place to visit, rather than live. Hence, it is urgent that we rethink our public housing design, to avert similar problems from arising from future public housing projects.

According to the results of the survey and analyses, the major findings of this study can be summed up as follows:

(1) The family type and size of low-rent housing tenants are varied. Multi-generation families and families living with old people are very common in low-rent housing. Prior to design, their realistic demands should be carefully considered.

(2) The tenants use the living room in various ways. In low-rent housing, the living room is not just for meeting, it also serves as a place for dining, studying, and storage. On occasion, it also serves as a sleeping area in multi-generation families. Hence, how to meet

various demands of tenants, given the space limitations, should be one of the important considerations. Generally, a living room with a wider space and a more regular shape is preferred.

(3) One more private bedroom is desperately needed. As mentioned above, multi-generation families are the large portion of the low-rent housing tenants. Since just one bedroom is available in low-rent housing, some other family members have to sleep in the living room temporarily. They have little privacy in such a public area. Although partitions made of glass were built between their extra bed and the common space in many families, the bad insulation against cold and sound created new problems.

(4) The kitchen and lavatory are considered minor spaces in low-rent housing. The tenants deem it defective, but somehow acceptable. Thus, we suppose that creating space for the living room by reducing the space in kitchen and lavatory would be sensible and acceptable for the tenants.

The design of public housing is a relatively new field for Chinese researchers. In other countries, it provided pretty good examples to Chinese authorities for their own construction and design. But different countries and regions have different cultures and customs. Hence, their experiences on public housing design and construction should be accepted selectively by Chinese authorities. This study is just the beginning with respect to housing unit usage and living experience of the tenants in public housing; it is anticipated that more in-depth research will contribute to developing more living-friendly Chinese public housing.

4.7 References

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5 Living Room as the Focus of Inhabitants

5.1 Living Room: the Primary Space for Chinese

The living room in different regions and countries was defined in different ways. Generally, a living room is a room used for relaxing and socializing, it also functions as a reception room at times. In traditional Chinese dwelling house, the living room was called “*Ting Tang*” (Figure 5-1). It usually just serves the function as a space for ceremonial meeting and is the spiritual and spatial core of one family. Currently, living room in Chinese housing have changed greatly, but it still be considered as the most important space in a house. A relatively universal living room arrangement is a television set and a set of sofas placed in front of the TV (Figure 5-2). It is popular and accepted by most of families. Similar arrangement also can be seen in public housing. However, given the economic status and family type of public housing residents, there is a high possibility that they have some special demands in living room. Our previous researches about residents’ living environment evaluations had supported this possibility. In Chinese public housing, the mismatch between limited area of dwelling unit

and residents' actual needs greatly affect their living experience. We believe the living room should become the most flexible space in a housing unit to maximally reduce the influence caused by this mismatch.



Figure 5-1 A traditional Chinese living room
Source: <http://www.farmer.com.cn>



Figure 5-2 A modern Chinese living room
Source: <http://www.hudong.com/wiki>

5.2 Typical Arrangement and Usage

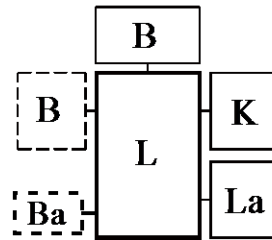
As mentioned above, the living room was considered the focal point which may affect residents' living experience greatly. Hence, the living room was picked up as the target of this chapter. We tried to classify the living room plans into different groups and explore

how the residents use the living room. After the descriptive analyses, some major factors with regard to living room design are expected to be pointed out which would be very helpful for Chinese public housing design in the future.

According to the relation between living room and other rooms, all of the floor plans we obtained could be classified into three groups (Figure 5-3). Most of dwelling units had separate living room which were classified as group one, called “Living room and Kitchen style (L&K style)”. Some units didn’t have a separate living room but a combined space was available functioned as the kitchen and living room. These like floor plans were classified as group two, called “Living room Kitchen style (LK style)”. The remaining floor plans were classified as groups three which were characterized by no living room and a hallway connecting all rooms. One point needed to be clarified was the classification was based on the current layout of dwelling unit. Because some of residents remodeled the original plans to meet their special demands, we believed their current floor plans may convey more useful information about their actual needs. The survey indicated 55% of dwelling unit had only one bedroom; while there are 3 members or more in 58% families. Thus, space for sleeping was not enough for these families. The common solution to this problem adopted by residents was placing an extra bed in the living room. That made the living room usage quite different from those families with no bed in living room. Hence, we further classified the living room usage into two groups, group (ii) placed an extra bed in the living room and another group hadn’t done that. Because some dwelling units in group three had no living room and were relatively special, we discussed it as one group.

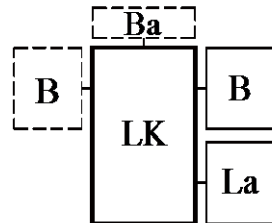
L & K Style (199/271)

- Living room is separate and is the center of the floor plan.
- One or two bedrooms are available.
- A balcony is available in some dwelling units.



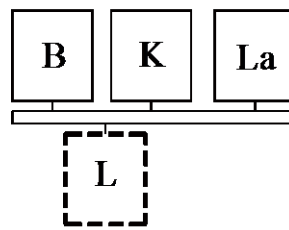
LK Style (57/271)

- The living room and kitchen were combined into a common space.
- A balcony is available in some dwelling units.



Others (15/271)

- Different rooms connected by a hallway.
- The space of living room is too narrow to be arranged appropriately.
- Some dwelling units have no living room.

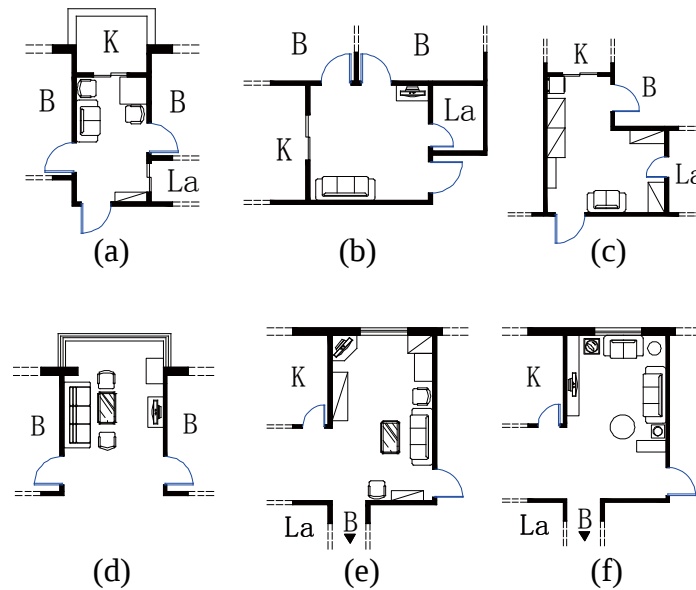


**B: bedroom Ba: balcony K: kitchen L: living room
La: lavatory LK: living room & kitchen**

Figure 5-3 Three living room styles

In general, the collected floor plans of our survey indicated that the living room arrangement of public housing was simple. They just had the most basic home appliances and furniture. Most of families had television set and refrigerator. Home appliances like air-conditioner, microwave were seldom seen in public housing families. Sofa, dinner table and chairs, storage cabinets were common furniture in public housing living room. These home appliances and furniture fulfilled the basic functions as a living room, and afforded basic support to residents' life. For group one,

L & K Style (i): No extra bed in living room (144/199)

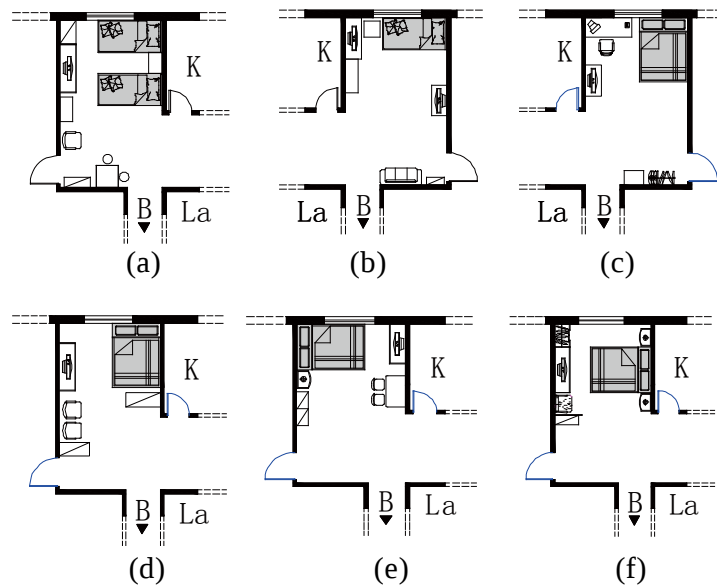


- I. Some living rooms are too narrow to hold basic furniture and household appliances. (a)
 II. Too many doors directly face the living room make it hard to be arranged. (b)
 III. If the shape of living room is irregular, people incline to use it as a place for storing. (c)
 IV. Common arrangement of living room. (d,e,f)

Figure 5-4 Typical living room usage in L&K Style (i)

the space of a separate living room can generally satisfy the residents' needs, according to our survey. But if one or two extra beds were placed in living room, it would become crowded. A separate living room was available in the units of the Group one (i). The sofas were simply arranged along the wall, and the television set was placed opposite. Usually, residents inclined to place a small table in front of the sofa. If needed, it also could be used as a dining space. This was a relatively universal living room arrangement, no matter in public housing or commercial housing (Figure 5-4). There were three main issues we found from this group. The first one was the area of some living rooms were too narrow to hold even the basic furniture and appliances. Secondly,

L & K Style (ii) With extra bed in living room (55/199)

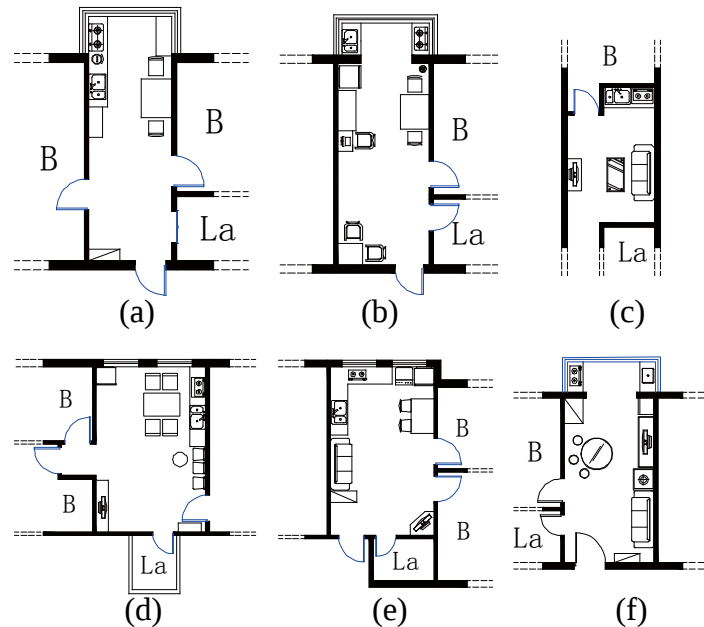


- I. The extra beds occupy much space in the living room.
 - II. The extra beds also serve the function as a seat when residents watch TV.
 - III. The living room is a place for studying or dining at times.
- (a,c,e)

Figure 5-5 Typical living room usage in L&K Style (ii)

some of living rooms had irregular shape which also makes it hard to be used efficiently. Thirdly, too many doors directly faced the living room in some dwelling units made arranging the living room very difficult. For those families who placed one or two extra beds in living room, the space in living room became inadequate apparently (Figure 5-5). Much space in living room was occupied by the beds. The extra beds commonly also functioned as a seat, thus, a sofa was hard to be found in these families. But, because the living room was a relatively public space, if no partition was available in living room, people sleeping here will lose the right to privacy. In other words, the extra beds made the living room more like a wider bedroom and lose part functions as a living room to a certain extent. According to the local regulations about public housing design, a separate living room was recommended. While the reality was there still were many floor plans adopted the form of combining living room and kitchen in a common space.

LK Style (i) No extra bed in living room (40/57)

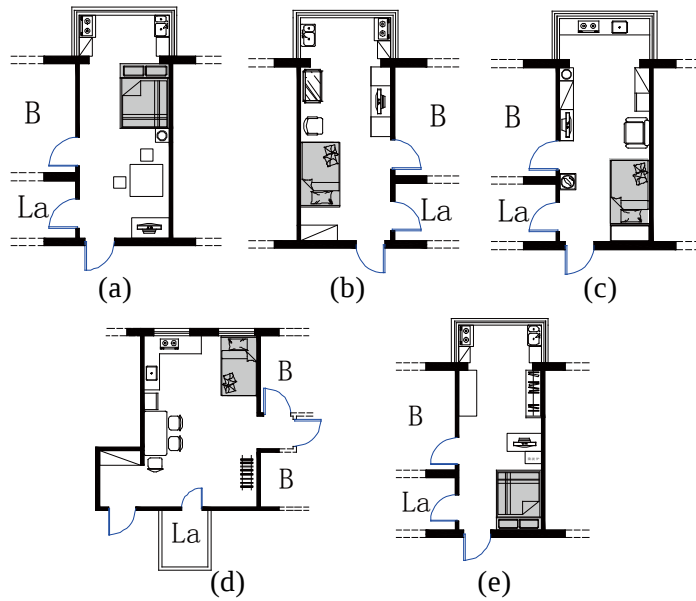


- I. The LK is mainly used as cooking and dining space. (a,b,d,e)
 II. Residents want to watch TV when they are dining. (c,f)
 III. Unlike a living room, the LK seems like a wider kitchen. Part function of living room is transferred to bedrooms.

Figure 5-6 Typical living room usage in LK Style (i)

Although the combined space was wider, the home activities here become complicated. The residents paid much more attention on its function as a kitchen. Cooking and dining occupied much space, got priority over meeting and those activities usually happened in a living room. Accordingly, the location of sofa, television set became awkward. Corner space was the common choice for them (Figure 5-6). If an extra bed was placed in the combined space, the space became more crowded. There was no obvious preference as to the arrangement in the combined space. The extra bed was placed in the corner space commonly and the remaining furniture and home appliances were placed along the wall simply (Figure 5-7). However, one point was clear that residents hoped they can watch TV when dining. Thus, placing a dining table in front of the television was very common in group two dwelling units. The dwelling unit plans of group three were characterized by no living room and a hallway. According to local public housing design

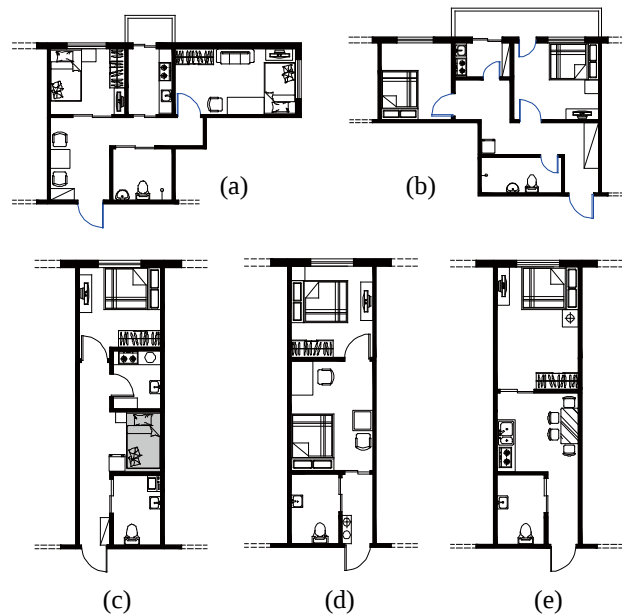
LK Style (ii) With extra bed in living room (17/57)



- I. Because of the extra bed, the LK become more crowded.
- II. People who sleeping in LK will lose the right to privacy totally.
- III. The activities which may happen in LK become complicated and have influence on each others.

Figure 5-7 Typical living room usage in LK Style (ii)

Others (15/271)



- I. There are no living room in some dwelling units.(a,b,d,e)
- II. Residents use the hallway for storing and dining.(a,b)
- III. The functions of living room are transferred to bedrooms totally. (a,b)
- IV. Some living rooms are too small to be arranged appropriately. (c)
- V. Remodeling floor plan is very common in public housing to

Figure 5-8 Typical living room usage in Others

regulations, the area of living room should reach 12 m². It was obvious that dwelling unit plans in group three hadn't met it. All of the rooms were connected by a hallway. Because there was no living room or the space was too narrow, television set and sofa which commonly should be placed in living room were moved to bedroom in these units. Remodeling also became very common in these dwelling units (Figure 5-8).

From the above discussion, it is clear that the living room in Chinese public housing hadn't been designed carefully. Public housing designers just provided a living "space" to residents; sometimes this space was hard to be called as a living "room". How will residents use this space hadn't been considered in the design process. This was one important reason causing their remodeling and renovating the floor plan. As we mentioned above, the mismatch between limited area of dwelling unit and residents' actual needs greatly affect their living experience. Given different family types and size, a fixed floor plan with specific area was hard to satisfy residents' diverse demands. At the same time, 20% of householders were 60 years old or older. It means the elderly people must obtain special attention. They need more support in their life, compared with common people. As far as we known, the Chinese public housing designers seldom communicate with public housing residents about their residential demands and needs. The public housing was designed just according to some official design regulations. We believe that is another important reason which caused the design cannot satisfy the residents. Generally, the living environment in Chinese public housing cannot satisfy the residents' demands and must be improved, especially the environment in the living room. At the same time, the residents' considerations should be reflected in our future public housing design.

5.3 Conclusions

The descriptive analyses provided us some helpful information on living room design in Chinese public housing. Through this

research, we can see how design affected the residents' life and residents' preference as to living room usage. After the analysis, we can conclude that a separate living room was preferred by residents and easier to use. However, if an extra bed was placed in living room, the space here will become inadequate. In combined living room, the limited space caused residents had to transfer some living room functions to bedrooms; while the living room seems like a wider kitchen. If no living room was available, the transference of living room functions will be more obvious. In summary, the living room space is very important for a public housing. Because of the diversity of family type and size, a flexible living room design is strongly recommended to meet residents' diverse needs. Designers should pay more attention to the actual demands of residents, communicating with them face to face is a useful way to obtain their concerns about housing environment which will make our design more pertinent.

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6 Design Guidelines for Public Housing Interiors Based on UD

6.1 Why Universal Design

The latest national statistics shows the proportion of old people (65 or older) in China to be 9.1%, exceeding the 7% which is a sign of an aging society. This is account for around 123 million people, who are suffering various inconveniences caused by aging. To improve the quality of life of the elderly people, scholars and related authorities have made many attempts to address these issues. A building design code was created, known as the “Code for design of residential building for the aged” in 2003. The code presented a set of criteria for building design. However, the incongruity between the given environment and the residents’ desired becomes an obstacle, which had always been a common factor in the public housing sector. Public housing policies are designed for low-income families in China as practiced in other countries. In China, an important component of this is the elderly. In addition, since the cost limitation is placed on public housing design and construction, the living environment becomes worse, compared with the condition in commercial housing.

In a long time, barrier-free design was a focus of concern for both the designers and users. The concept of barrier-free design is relatively easy to be accepted by the majority of people, regardless of gender, age, and religion. That is because people with mobility impairment and the elderly are so usual that can easily attract the attention from the public. It is widely accepted that they should be given the same access to public buildings and social services. However, the public as well as some building designers incline to treat them as a special group of the society, especially in the developing and countries like China. Numerous public facilities for a better accessibility are specially designed for those with some certain physical impairment and the elderly. It was called a second handicap by I. Hachihasanoglu (1997) or age-specific design (Kose, 1998). As insight into the equal access concept increased, universal design came into light and begun to be accepted by more and more designers. It was defined as “an approach to creating environments and products that are usable by all people to the greatest extent possible” in the USA. Just like Ronald L. Mace (1998), who use the term of “universal design” first, said, universal design is not a new science, all previous researches on improving the accessibility and usability of our living environment and products should be considered the base of this innovative concept. Currently, the concept is receiving widespread support throughout the world. In architecture, architects are trying to design buildings which could be used by all equally, regardless of users’ age and capability. One point we need to clarify is that a truly universal design is impossible to some extent (Mace, 1998). What we can do is making our design more universal or more nearly universal. That signifies the degree of universality in a building is a flexible range. It is changeable according to the original goal in universality set at the beginning of design and affected by cost limitation, special demands or other elements.

Chinese public housing system was established after a housing

reform took place in 1998 and just has a relatively short history, compared to America and most European countries. Since a priority in access to public housing is provided for the elderly, the population aging in public housing is more serious than commercial housing in this country. In addition, the construction cost of the public housing project usually is controlled which cause inadequate concerns on the living environment and accessible design. The government tends to invest money in some more fundamental sectors than it does in improving the accessibility and usability of public housing. This phenomenon occurred not only in China, but also in other developing countries (Kose, 1998). The elderly in public housing therefore are suffering from various mental and physical inconveniences aroused from inappropriate design. Although, a national code for design of residential building for the aged was issued in 2003, this code was ignored generally in current public housing design and just be fulfilled in some facilities exclusively for seniors like senior apartment or nursing homes. Just few parts of seniors can benefit from the implementation of this code since the majority of seniors in China are living with their family together rather than living in a senior apartment or nursing homes. If the criteria in the national codes were carefully reconsidered, we may find that it is highly necessary to refine some of them to make them applicable to a more complicated situation. As aging, people would focus on indoor activities more because of the decline in physical capability and mobility (Demirkan, 2007). Accordingly, the indoor environment would greatly affect their living satisfaction and has a close relation with their quality of life. In this chapter, we concentrate on the interior spaces in the housing unit, discuss about the specific criteria for each space based on UD. As a result of these analyses, a design guideline is developed to guide the practice in the future.

6.2 Universal Design in Japan

The new tendency of housing policy development in Japan has

been discussed in chapter two. Improving the quality of current housing and the newly built housing has been one of the most important objectives of the new policies. As a crucial approach, universal design concept is adopted widely in Japan as the basic concept for housing and urban renewal. Related researches were conducted by many Japanese scholars, including the studies on how to introduce UD to current housing construction and urban renewal and the means of valuation of UD. Some of the research outcomes are accessible for the public. Everyone can download it from the homepage of the authorities, and the related news also could be found from the mass media. Hence, UD is not a new concept in Japan and is widely accepted and used in various fields, such as product design and building design.

In Tokyo, UD was firstly considered important for city planning in the report of “The vision of city planning for social welfare in 21st century”, issued by the council of promoting city planning for social welfare in Tokyo (東京都福祉のまちづくり推進協議会) in 2003. At the initial stage, public facilities firstly became the focus and then all the buildings managed by TMG (Tokyo Metropolitan Government) were involved. In 2005, “The fundamental guidelines for TMG’s facility maintenance based on UD¹” was jointly designed by the Bureau of social welfare and public health and Ministry of land, infrastructure, transport and tourism. Then, “Universal design introduction guidelines of TMG’s

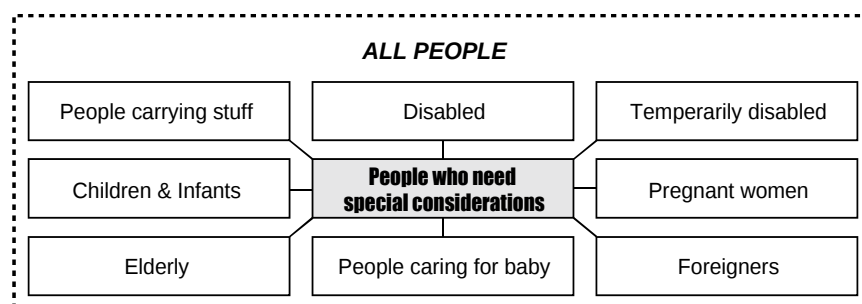


Figure 6-1 Target people of UD (Redrawn by the author)

¹Available at :http://www.zaimu.metro.tokyo.jp/kentikuhozen/eizen/ud/ud_index.htm

buildings” was developed by Committee on formulation of universal design guidelines for TMG’s buildings, which was established in December 2005. In this guideline, the target populations (Figure 6-1) and the steps (Figure 6-2) to achievement in UD introduction are clarified. Nowadays, many TMG’s buildings are remodeled according to the guidelines to make it more usable for all users.

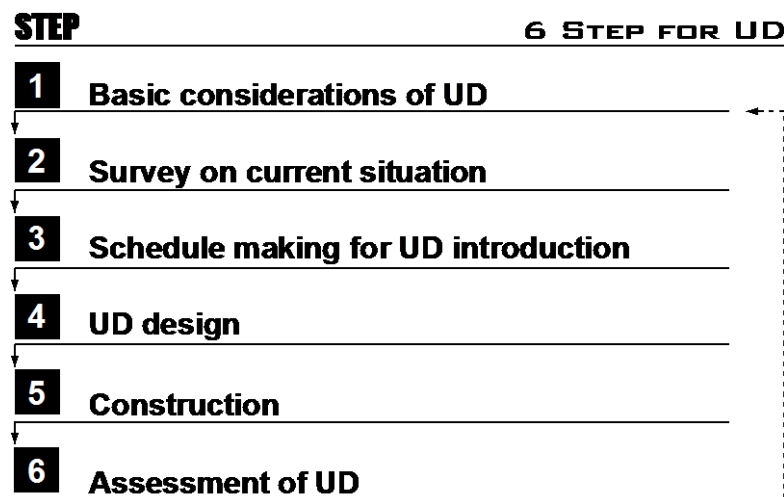


Figure 6-2 Six steps for UD

The detailed design guidelines for housing design are available in many Japanese cities. The example discussed here comes from Hokkaido. In the 8th term of 5-year housing construction plan in Hokkaido, achieving the safety and comfortable living for all people from children to the elderly became one of the fundamental objectives of the plan. The “safety residence project” was launched then, in which the study on public housing design based on the evaluation of residents and care givers was conducted. Meanwhile, from the viewpoint of UD, a new approach to maintenance of public housing was promoted. In 2005, a design guideline for public housing was issued by Hokkaido government. In the guideline, the universal housing design is presented by pictures and photos, which is friendly to those unfamiliar with the topic. How to design and remodel building and housing unit features based on UD is answered by a list of criteria for each space. It is a very good

introduction of UD for the public and a referable material for architect and any practitioners of public housing construction. Similar guidelines could also be found in other districts.

Not only the government, but also many responsible corporations involved in the process of introducing UD to various fields. Such as, the ITOKI company which focuses on office furniture design with both more UD and ecological features². Another Japanese company named TOYO-INK³ devotes to develop the technique in color universal design for those who cannot correctly recognize color.

Generally speaking, the government is the major promoter to spread UD concept. In Japan, the governments try to promote UD in government-owned buildings, including part of public facilities and public housing. After UD was accepted by more people, more private companies and public institutions join in introducing UD into other fields. Thus, similar with Japanese governments, Chinese governments should take responsibility of introducing UD to the public. A feasible way is putting UD concept into practice in public housing construction firstly, since public housing construction is directed by the government. Moreover, the variety of public housing residents makes UD practice in public housing more meaningful.

6.3 Current National Design Codes for Residential Building

Concerning residential building design, there are two national codes currently available in China, they are “Design code for residential building”, and “Code for design of residential building for the aged”, issued in 1999 and 2003 respectively. The former one must be followed at all residential building constructions; the

² See details at: <http://www.itoki.jp/solution/product/>

³ See details at: <http://www.toyo-uding.com/>

later one is required to be met at some building constructions for the elderly exclusively, such as nursing home and apartment for the elderly specially. Besides the above national codes, design for the handicapped is discussed in another national code called “Code for design on accessibility of urban roads and buildings” which mainly focuses on accessibility of city roads and part of public buildings. There is no code about accessibility and usability of residential building in China. Table 6-1 shows the criteria for each interior space in the two national codes. Some of them are same with each other. Generally, the design code for the elderly involves some barrier-free design features, and the regulations on room size are amended for a safety and comfortable living environment. If we look at the both codes, we may find that both of them cannot achieve a universal environment. The main shortcomings of the two codes are: (1) The design code for residential building takes the most common people as the users of housing units. Thus, few universal features could be found in it. (2) The design code for the elderly only applies to those buildings which are designed for the elderly exclusively, such as nursing home or senior apartment. The public housing designers are not compelled to follow these regulations. Moreover, there are size limit for public housing unit. Achieving universal design in public housing therefore is difficult to a certain extent. However, it is possible if we look at this issue in detail.

Table 6-1 Current national design codes for residential building

Interior spaces	Design code for residential building	Code for design of residential building for the aged
Entrance	❑ Clear width of the hallway should be not less than 1.2m.	❑ The clear open of the entry door should be not less than 1m. ❑ Space for clothes and shoes changing, as well as bench and grab bars should be provided. ❑ The entrance is required to be stepless, if a threshold is set, the height of it should not higher than 20mm. ❑ Set small window in the door. ❑ Level door handle is recommended.
Living room	❑ Usable space of living room should be not less than 12m². ❑ Reduce the amount of doors facing living room directly. ❑ Have good natural lighting and ventilation. ❑ The length of the wall attached to furniture should be 3m or longer.	❑ The enclosing walls of the living room should not shorter than 3m. ❑ If a living room is connected with either kitchen or dining room, they should be located on an accessible ground floor entry level. ❑ Have good natural lighting and ventilation.
Bedroom	❑ Have good natural lighting and ventilation. ❑ The minimum size for double room: 10m²; ❑ For single room: 6m².	❑ The enclosing walls should be longer than 2.5m in an aged people's bedroom, 3.2m in a wheelchair user's bedroom. ❑ Space for caring around each bed. ❑ Sliding doors are preferred. Swing doors with a lever door handle are also acceptable.
Kitchen	❑ Minimum size for kitchen in Class I & II housing unit: 4m². ❑ Minimum size for kitchen in Class III & IV housing unit: 5m². ❑ Have good natural lighting and ventilation. ❑ Close to the entrance of housing unit. ❑ The length of worktop should be not less than 2.1m. ❑ The clear width of the kitchen should be not less than 1.5m when a corridor type is adopted. ❑ When double galley type is employed, the clear width between the two galleys should be not less than 0.9m.	❑ Minimum size of the kitchen for aged user is 4.5m²; minimum size of kitchen for the disabled is 6m². ❑ Turning space (1.5m diameter). ❑ Work surface (750mm high maximum for wheelchair user), clear knee space (700mm high, 250mm depth minimum).
Bathroom	❑ At least, one bathroom must be provided in each housing unit. ❑ Minimum size of bathroom when toilet, lavatory countertop and bathtub are equipped: 3m². ❑ The door of bathroom should avoid facing living room and kitchen directly. ❑ Space for washing machine should be provided.	❑ The bathroom should be adjacent to bedroom for the elderly. ❑ Non-slip floor surface and stepless floor. ❑ Clear door width 800mm minimum. ❑ Sliding door is preferred, small window in door and enables families to open the door from outside. ❑ Grab bars equipped in place. ❑ Tub with integral seat.
Balcony and storage space	❑ Every housing unit should have balcony. ❑ The height of railing at balcony should be not less than 1.05m in low-rise building and 1.1m in high-rise building. ❑ Facilities for laundry airing should be designed at balcony. ❑ The height of hanging cabinet should be not less than 0.4m. The depth of in wall cabinet should be not less than 0.5m.	❑ Railings with clear height 1.1m minimum, either at an open balcony or closed balcony. ❑ Fixtures for clothes airing; adjustable height rods. ❑ An organized drainage, waterproof floor covering. ❑ Small garden enables planting at the balcony is recommended.

6.4 Design Guidelines for Public Housing Interiors

Although, accessibility related national codes have been issued for many years, it is hard to say all the current residential buildings meet the requirements of these national codes, especially for public housing which is suffered a limited construction cost. Nevertheless, these national codes still provide us with some specific expertise on improving accessibility and usability in residential building, even though they are incomplete.

Universal design practices in other countries and English literatures on this topic can offer Chinese scholars and authorities with valuable references. They are the best lessons for a fresh country in the process of introducing universal design to the public. Many cities in America and Japan developed their own universal design guidelines for residential building, according to local living culture and custom. These released guidelines are important references to develop Chinese own guidelines for universal design in residential building. However, given the cultural difference between different countries, the residents' expectations for housing space may differ from each other (Kose, 1998). Therefore, singling out the contents which apply to Chinese circumstances and refining the inapplicable contents according to Chinese living culture would be the focus of this section. The following contents are criteria for housing interiors derived from current Chinese national codes and norms of different countries, as the standards of assessment in the next section. Considering the current financial situation of the local governments, a more cost-efficient solution to improve the accessibility and usability in public housing is more preferred and feasible. Thus, items which are expensive to achieve are not included in the control lists, which may increase the construction cost remarkably. Meanwhile, the control lists we will discuss apply to public apartment and high-rise public housing. There is no detached public housing in China, and therefore it will not be taken into consideration.

6.4.1 **Criteria for entrance**

The entry into a housing unit is not only an entry but also serves as the exit (Raschko, 1991). Thus, both sides of the entry door should be barrier-free to satisfy the needs of the elderly and the handicapped. The most usual actions here may be checking the door number, opening the door, putting down the things in hand, taking off the coats, checking the visitors or having a short talk with visitors. In order to improve the accessibility and usability here, the following criteria are supposed to be followed. Figure 6-3 shows an image of a universal entrance designed according to the criteria.

Criteria for the entrance

- 1m clear opening width of the entry door.
- Stepless entrance is preferred.
- Entrance thresholds should not be higher than 20mm.
- Equip lever door handle with a height of 800-850mm.
- Entry aisle should be 1200mm minimum in width.
- Space for taking off clothes and shoes should be provided, including bench and grab bars in place.
- 1.5m*1.5m clear space minimum inside and outside entry door.
- Lighted doorbell at a reachable height, intercom with portable telephone link.
- Light outside entry door and motion detector controlled lights.
- House unit number should be large, high contrast, located in a prominent place.
- Space to park stroller and mobility device such as wheelchair.
- A shoe cabinet with a height of 900mm and a depth of 500mm.

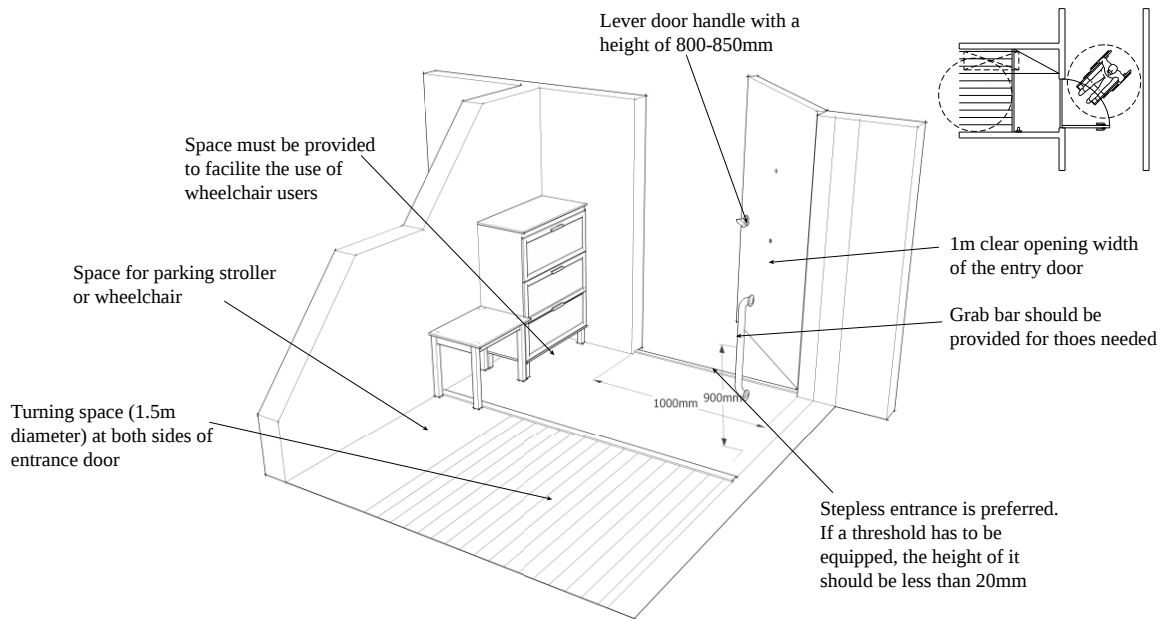


Figure 6-3 An image of a universal unit entrance

6.4.2 Criteria for living room

For the elderly and the handicapped, their limited physical capability makes them have to focus on indoor activities. These activities usually may happen in living room, and it therefore becomes a very important place of family activities, both for regular families or families with the elderly and the handicapped. Basically, the function of living room as a place for family activities is fulfilled by furnishings, such as a sofa, a television set and chairs and their arrangement. Furthermore, different families may have special preference on indoor activities and require particular design strategies. Thus, the control lists discussed here are those relatively common, which must be considered in every public housing project. The special needs and demands of different families should be carefully considered case by case. Figure 6-4 is an example of a universal living room designed according to the criteria.

Criteria for living room

- 12m² space minimum in living room.
- The enclosing walls of living room should not shorter than 3m.
- If a living room was connected with either kitchen or dining room, they should be located on an accessible ground floor entry level.
- Direct natural lighting and ventilation.
- An open plan design (easy access to different rooms, maximize sight lines).
- Turning space (1.5m diameter).
- Provide 1.2m*1m staying place for wheelchair user.
- Avoid projections on walls.

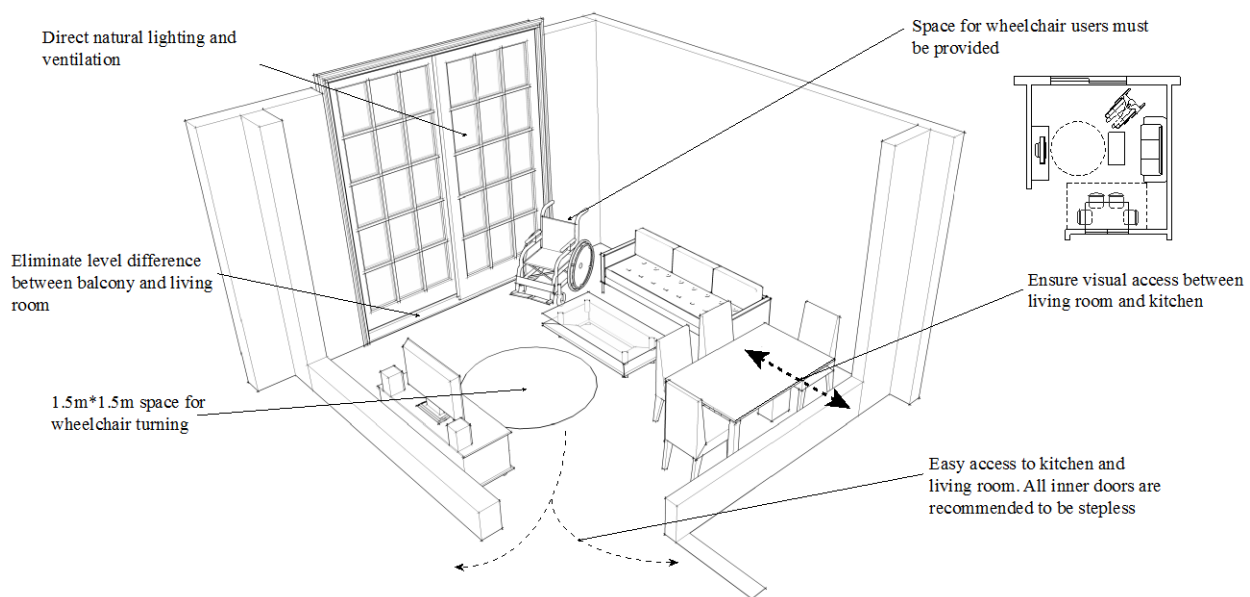


Figure 6-4 An image of a universal living room

6.4.3 Criteria for bedroom

It has been demonstrated that the Chinese elderly prefer sleeping separately (Zhou, 2009). Accordingly, bedroom is supposed to be wide enough to accommodate at least two twin beds with adequate caring space around each of them. Ambient characteristics, such as temperature, natural lighting and ventilation, should be taken into account to provide a comfortable environment in the bedroom.

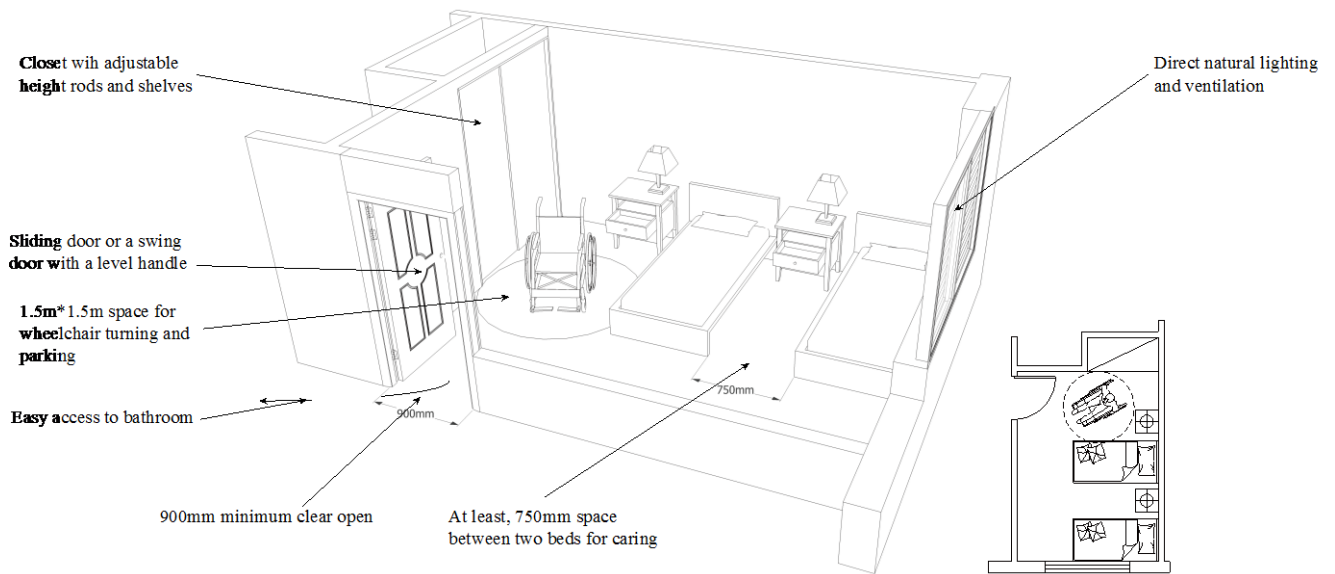


Figure 6-5 An image of a universal bedroom

Also, since the elderly may need to use the bathroom frequently in the night, easy and safe access to the bathroom should be ensured. Figure 6-5 is an image of a universal bedroom.

Criteria for bedroom

- The enclosing walls should be longer than 2.5m in an aged people's bedroom, 3.2m in a wheelchair user's bedroom.
- Space for caring around each bed (750mm minimum at each side).
- Sliding doors are preferred. Swing doors with a lever door handle are also acceptable.
- Minimum 12m² for double bedroom and 10m² for single bedroom.
- Adjustable height closet rods and shelves.
- Clear door opening width of 850mm minimum.
- Turning space in bedroom (1.5m diameter).
- Easy access to bathroom.

6.4.4 Criteria for kitchen

Basically, a well-designed kitchen should enable users to efficiently perform the task of food preparation, cooking and serving, cleaning and storage. Chinese traditional home cooking may generate more smoke as compared to other forms, which makes ventilation an important factor in the kitchen environment. Consequently, a totally open kitchen may not be appropriate in a Chinese housing unit. A visual access to living room should be ensured to enable the cooker to supervise the activities of other family members in the living room while cooking. Clearance under the countertop should obtain enough attention to improve the accessibility for wheelchair user, and it is more usable for people in a seat as well. Meanwhile, pipes under a tank should be protected to avoid direct contact with user's skin. Figure 6-6 shows an image of a universal kitchen.

Criteria for kitchen

- 4.5m² space minimum for aged user, 6m² space for wheelchair user.
- Turning space (1.5m diameter).
- Work surface (750mm high maximum for wheelchair user), clear knee space (700mm high, 250mm depth minimum).
- Work surface should be 2.1m minimum in length.
- Single line kitchen should be 1.5m minimum in width. In double line kitchen, minimum 900mm in which between face of cabinets.
- Full height pantry storage with easy access pull-out and adjustable height shelves.
- Variable height work surface, space for typical kitchen appliances (rice cooker, refrigerator, microwave, etc.).
- Lighting to illuminate work areas without too much reflectivity.
- Adjustable height shelves in wall cabinets.

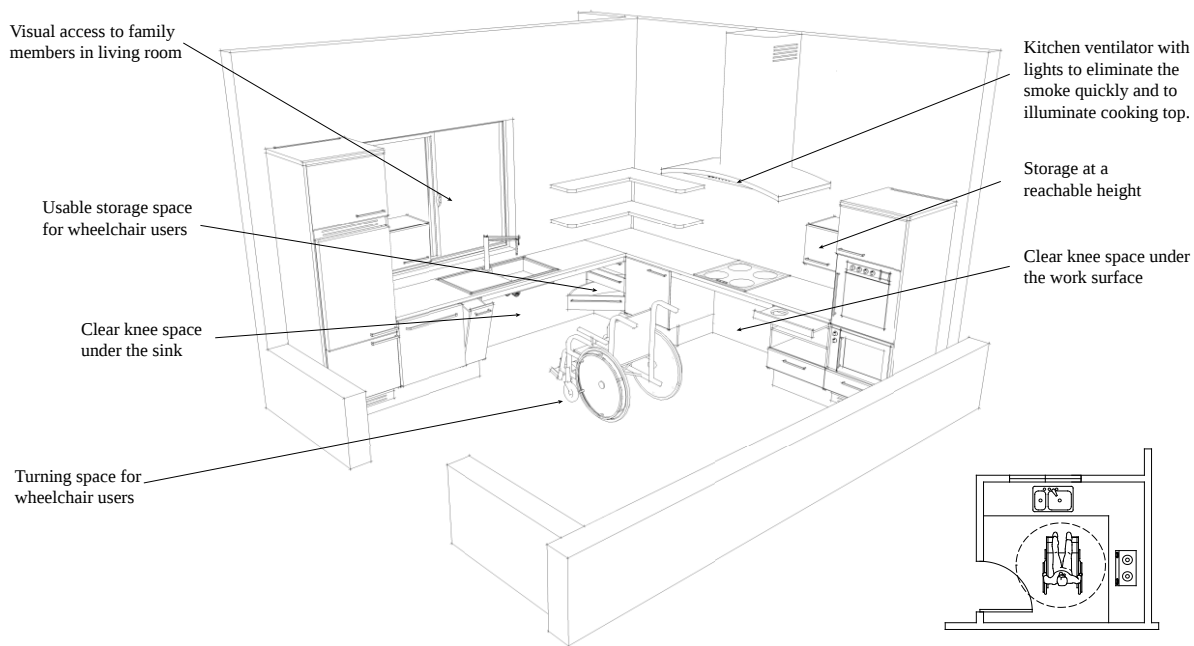


Figure 6-6 An image of a universal kitchen

- Single-lever water controls at all plumbing fixtures and faucets.

6.4.5 Criteria for bathroom

Bathroom contains many unsafe factors for the elderly and the handicapped, such as the wet floor covering, hot pipe and so on. Protecting users from these like unsafe factors is a major task of public housing design. Figure 6-7 shows an image of a universal bathroom.

Criteria for bathroom

- The bathroom should be adjacent to bedroom for the elderly.
- Non-slip floor surface and stepless floor.
- Clear door width 800mm minimum.
- Sliding door is preferred, small window in door and enables families to open the door from outside.
- Tub with integral seat.

- Lavatory counter height 800mm minimum with clear knee space.
- Turning space (1.5m diameter), clear floor spaces at each fixture.
- Clear space (900mm) in front of toilet. 700mm minimum away from the wall.
- Adjustable grab bars which could be easily relocated; grab bars should not be stainless steel.
- Pedestal lavatories are not acceptable.
- Mirrors are placed to allow appropriate viewing from any height.

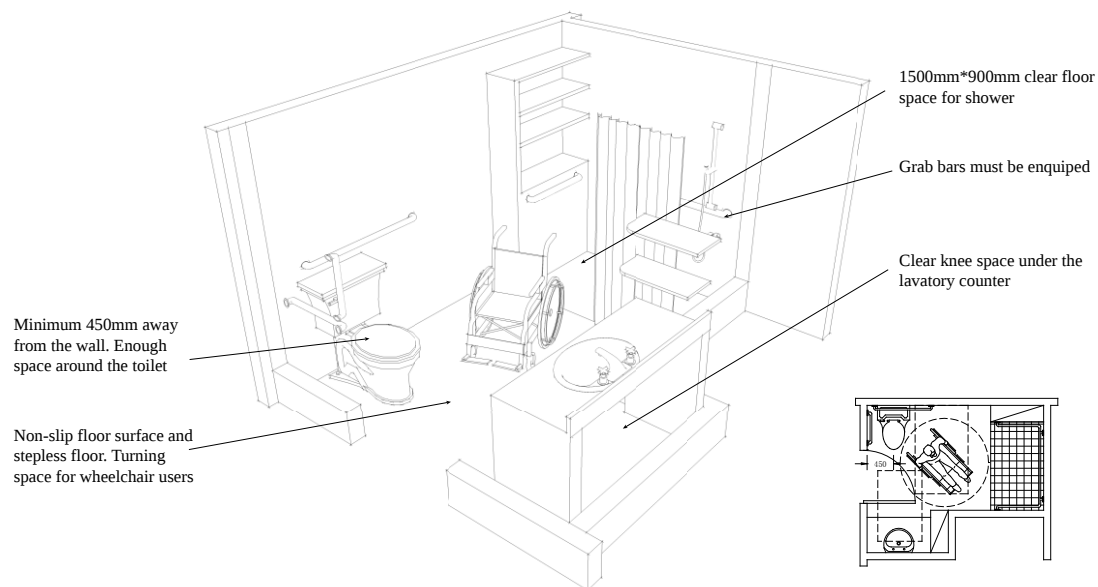


Figure 6-7 An image of a universal bathroom

6.4.6 Criteria for balcony and storage

Balcony and storage space are relatively minor space in a Chinese housing unit, but in certain cases, they still greatly affect the residents' living satisfaction. According to the survey we conducted in August 2012, residents commonly consider them a minor space and have a widespread acceptance. Nevertheless, the circumstance may be totally opposite for the elderly and the handicapped, since their limited physical capability restricts their easy access to balcony and storage spaces in some cases.

Criteria for balcony and storage

- Railings with clear height 1.1m minimum, either at an open balcony or closed balcony.
- Fixtures for clothes airing; adjustable height rods.
- An organized drainage, waterproof floor covering.
- Small garden enables planting at the balcony is recommended.
- Build balcony at the same level as house floor.
- Given the turning of wheelchair, a minimum 0.6m depth should be ensured.
- 850mm minimum clear width of the door between balcony and indoor space.
- Storage cabinet in bathroom should be waterproof.*
- Knee and toe clearance should be provided.
- 50% of all storage should be less than 1.3m.

6.5 Case Study and Discussion

In this section, two typical housing units are picked out as a case study. We will single out some common issues in these two units which are also common in other interviewed units. Discussion would be centered on the shortcomings of current interior spaces, and the effective initiatives to improve the situation.

6.5.1 Case A

This case is a two-bedroom type unit. Family living in this unit includes a 60 years old woman, a young couple and a one year old child, a typical three-generation family. All of the family members have a good health status. The main complaints come from the residents are the poor natural ventilation and lighting in the living room, no balcony which causes the inconvenience of giving clothes an airing, and inadequate storage space (Figure 6-8 & Figure 6-9).

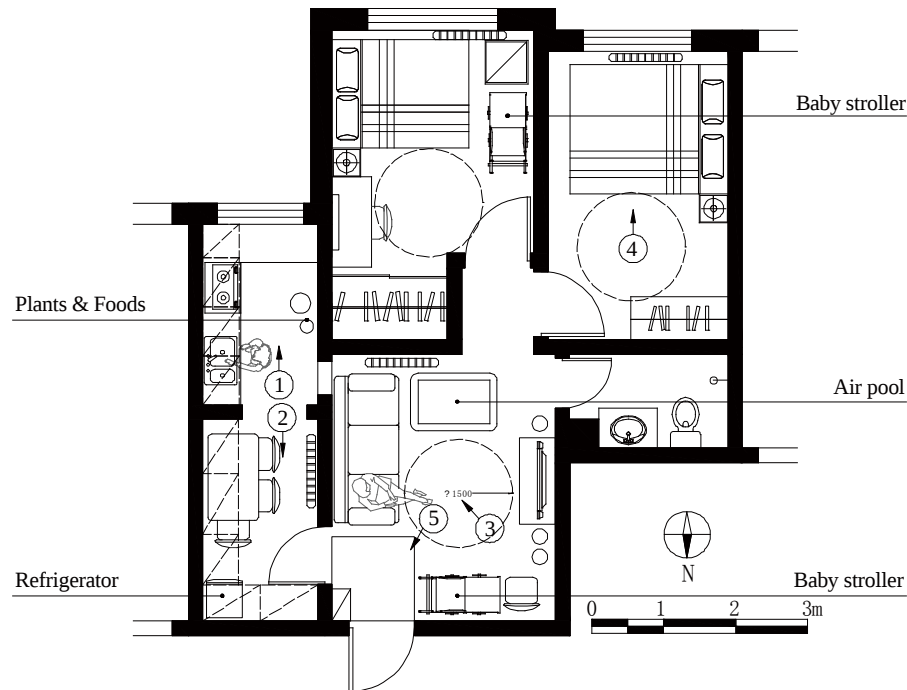


Figure 6-8 Interior layout of case A unit

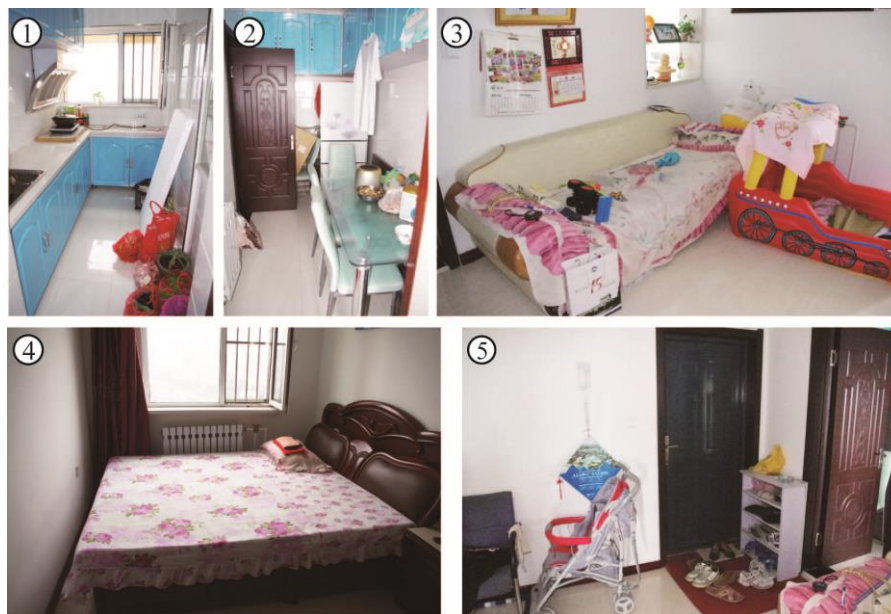


Figure 6-9 Interior pictures of case A unit

The main problems on accessibility and usability of Case A unit are as follows:

- The doormat and shoe cabinet at the entry obstruct the passage of wheelchair and are hazardous for the elderly.
- The width of the entry door of 0.9m hasn't met the national

codes, in which the width is required to reach 1m.

- Telecom and switch are equipped at an unreachable height for wheelchair user and children.
- Just one peephole is provided, which is not usable for wheelchair user and children.
- Living room size doesn't satisfy the national codes.
- Heaters in living room, dining room and bedrooms have no protections.
- Living room is relatively closed, and has no direct access to kitchen.
- Natural light and ventilation in living room are poor.
- Space for caring around the bed is inadequate.
- Closet in bedroom is not stepless.
- Rods and shelves in the closet are not adjustable.
- No clear knee and toe space under the work surface and storage units.
- The width of the kitchen hasn't met the national code and should be widened.
- Floor covering material in bathroom is waterproof but slippery.
- No grab bars are available in the bathroom.
- The clear opening of the bathroom door is 650mm, which is inaccessible.
- Bathroom size is too small to be usable for wheelchair users.

6.5.2 Case B

There are two family members living in this housing unit, one of which is suffering from mental disorder and needs assistance in his daily life. Same with case one, two bedrooms are available in this housing unit. The main complaints come from the residents are the hallway cannot accommodate a shoe cabinet, no natural lighting in the living room and no natural ventilation in the kitchen (Figure 6-10 & Figure 6-11).

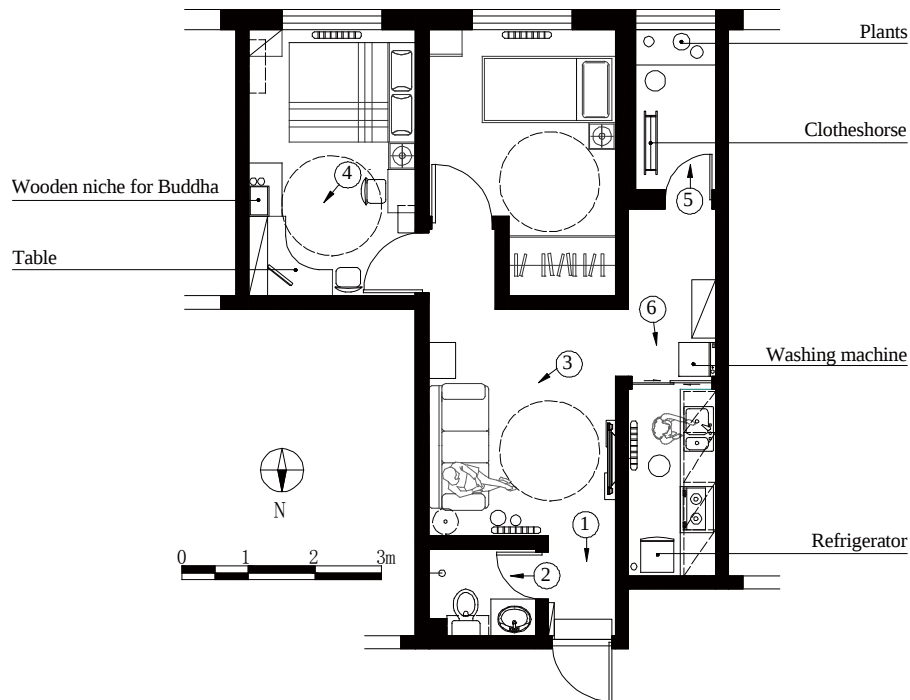


Figure 6-10 Interior layout of case B unit



Figure 6-11 Interior pictures of case B unit

Based on the criteria we discussed above, the main problems of this unit can be concluded as follows:

- Height of the entrance threshold exceeds 20mm, which may negatively affect the passage of wheeled devices.
- The hallway is too narrow to accommodate a shoe cabinet and hasn't met the national code, in which the width of it is required to exceed 1.2m.

- The telecom and the switches are equipped at a height out of the reach of the wheelchair users and children.
- The doormat at the entry obstructs the passage of wheelchair user.
- Natural light and ventilation in living room are unsatisfying.
- All heaters have no protection in this unit.
- Kitchen size is too limited and hard to use conveniently.
- Ventilation in kitchen is poor.
- No clear knee space and toe space may cause incontinence to wheelchair user and those who want to work in seat.
- The above-counter storage units at a height out of the reach of most users.
- Pipes in kitchen are totally exposed with no protection.
- Bathroom is too small to be usable and accessible.
- Slippery floor covering, no grab bar and pedestal lavatory reduce the usability and accessibility of bathroom.
- To use bathroom at night, users have to pass through the living room. This is unsafe and inconvenient for the elderly.
- The water head in bathroom is fixed and not adjustable.
- Swing door is a kind of obstacle for the wheelchair user to enter the bathroom easily.

6.5.3 Discussion

In case A, the family member features a one year old child and a young old people. While, in case B, a family member with mental disorder becomes the most distinctive trait. According to universal design concept, their needs on living environment should be carefully considered in the phase of design. The assessments on different spaces in the two cases were shown in the last two columns of each table. The most obvious difference between the two cases is one has a closed balcony and the other one doesn't. Aside from this point, they generally have similar accessibility and usability. The analyses of accessibility and usability imply some common issues must obtain more concerns from building designers

before and during the design phase. Firstly, housing size is apparently not enough which is an essential problem for achieving accessible and usable space in a housing unit. In China, public housing size is restricted in a certain range, both for affordable housing (within 70m²) and for low-rent housing (within 50m²). Under this regulation, no matter how large one's family is; the size of one housing unit is fixed. For those big families, which have three family members or more, the housing unit size even cannot satisfy their basic needs on number of bedroom, much less satisfy their needs on accessibility and usability. Therefore, it is pressing to take family type and size into account when develop related regulations. Then, more realistic and effective solutions to improve accessibility and usability could be achieved accordingly. Secondly, safety is another point left out and needs improvement. Unprotected heater and pipes, doormat, slippery floor covering and over-high threshold, all these factors may cause hurt or injury to family members, especially to wheelchair users and the elderly. Security should be the primary and fundamental elements building designers should address, before they attempt to make the living environment more accessible and usable. Thirdly, the current public housing floor plan is close to some degree in China. Every room is separated from each other, which makes the activities in one room invisible for those family members in other rooms. For some relatively private space, such as a bedroom, it may be reasonable. While, for children and the elderly, doing activities in a separate room without supervision may be hazardous and should be avoided. Thus, an open floor plan which can provide maximum visual access to each space and necessary personal privacy at the same time is more recommended. Finally, some concepts like adaptable housing or life span design also may contribute to the achievement of universal design and should be taken into consideration. Adaptable design could satisfy diverse needs of different families on accessible and usable living environment. Meanwhile, life span design concept decrease the inconvenience

one may meet as aging, and reduce the possibility of remodeling the housing unit. These concepts should be integrated into the design criteria for public housing. In addition, a completely universal design is impossible, which have been accepted by many scholars. Making the interiors “more universal” under a certain budget should be one important research goal and is more realistic and feasible for China, instead of chasing utterly universal spaces.

6.6 Model Unit Design

In this section, the model housing unit designs are presented. The model housing design is made based on the floor plans I obtained in the survey. The preceding guidelines are employed in the model design. According to our survey, two bedrooms could satisfy the most of residents. Hence, two model unit designs are provided in this section, including a one-bedroom type and a two-bedroom type. The basic considerations of the model design are to improve the accessibility and usability of the interiors, and to improve the adaptability of the housing unit to satisfy the diverse residents' demands. One thing need to be clarified is that the model designs are a kind of explanations for the design guidelines. Amendments must to be made according the actual situation in practice.

In China, a size limit is imposed on public housing unit. I have discussed this in the preceding chapters. In case of Shenyang city, the size limit for public housing unit is 50m^2 for low-rent housing unit and 70m^2 for affordable housing unit. However, some cities have more restrict limit on the size of affordable housing unit. The maximum size of affordable housing unit is 60m^2 in these cities. Hence, the sizes of model unit design are limited within 50m^2 for one-bedroom type and 60m^2 for two-bedroom type, which are valid in most circumstances.

6.6.1 One-bedroom type

Comparing to the current public housing unit, the sizes of kitchen

and bathroom are enlarged in the model design to improve the accessibility and usability of the two rooms. Wheel chair users require more space to complete daily activities. If the accessibility of the rooms could satisfy them, it will fulfill most of the users. In the model unit, there is not too much home furniture. The reason is that I found the public housing residents, especially low-rent housing tenants, have little home furniture. Probably because they don't have enough money to afford them. Hence, in the model unit, only basic furniture is arranged in each room. The room arrangement could be changed according to the residents' actual needs. Figure 6-12 shows the model unit design with some important design tips.

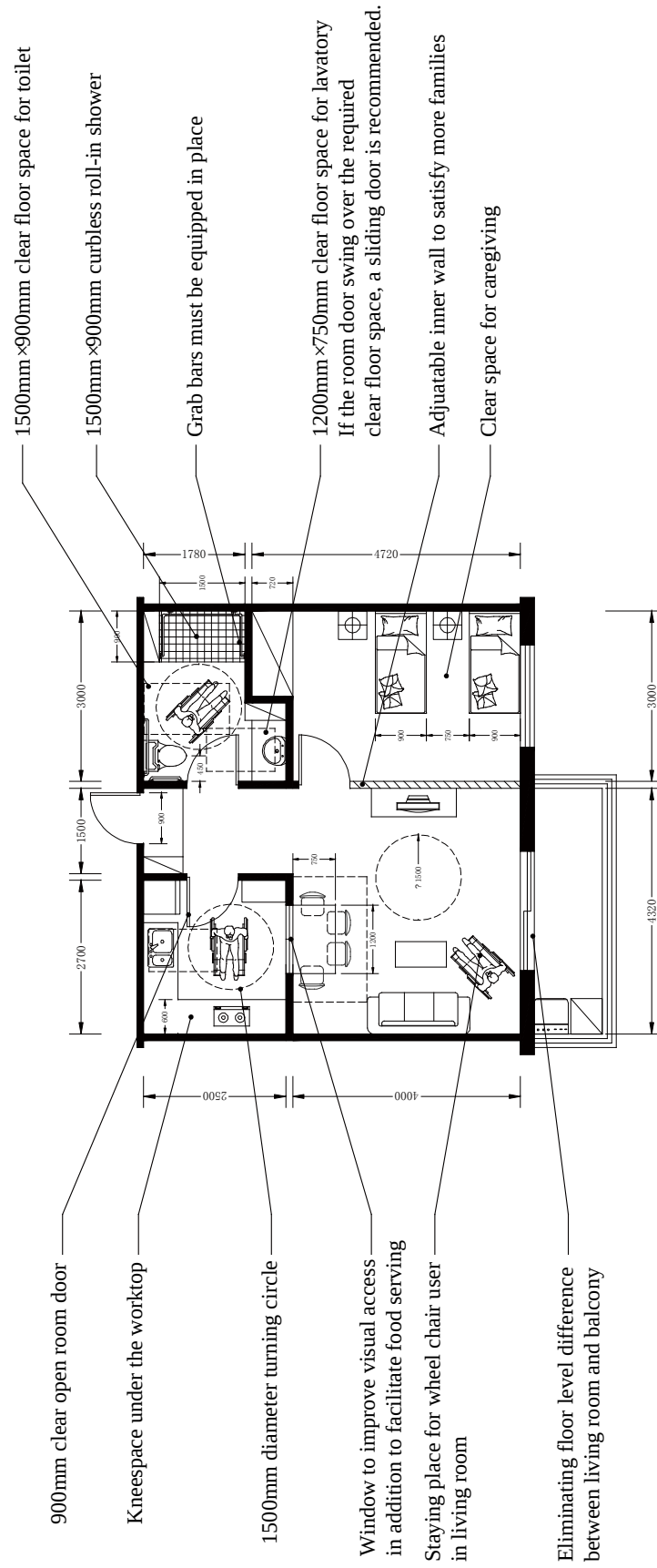


Figure 6-12 Model unit design of one-bedroom type unit

Adaptability is another important consideration in the model design. In the survey, one meaningful finding is that remodeling is very common. It implies that the current housing unit could not satisfy part of residents. If adaptability could be considered in the original unit design, the remodeling would be more easy to achieve and will satisfy more residents. According to the survey, most remodeling is to separate one more room for bedroom. Thus, in the model design the size of bedroom is much wider than the required minimum size of bedroom in the national code. And the inner wall between the living room and bedroom is changeable. By doing so, the bedroom could be easily enlarged or separated by residents themselves. Two examples of remodeling are presented in Figure 6-13 and Figure 6-14.

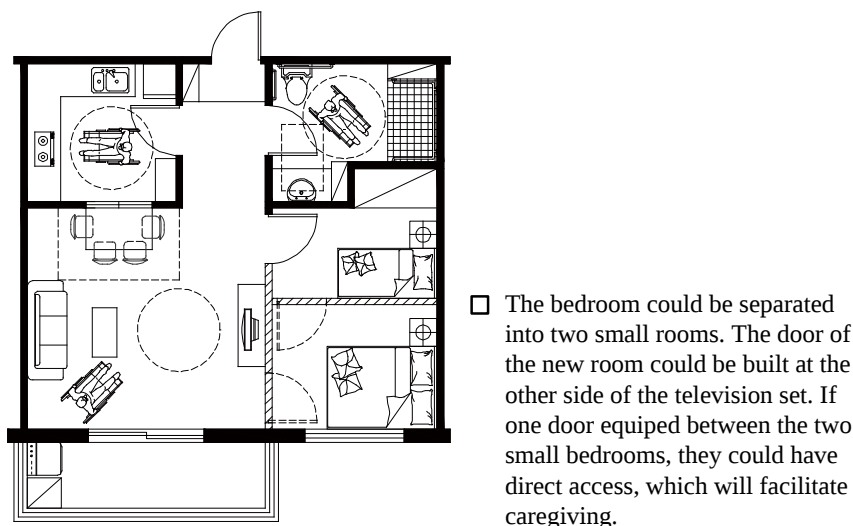


Figure 6-13 Bedroom remodel example of one bedroom type (i)

In this example, the remodeling will surely have negative affect on the accessibility of the housing unit. However, to fulfill the most pressing needs, the compromise is necessary in some cases. And from the interview, I also found a small bedroom didn't show apparent positive or negative correlation with the residents' overall satisfaction level.

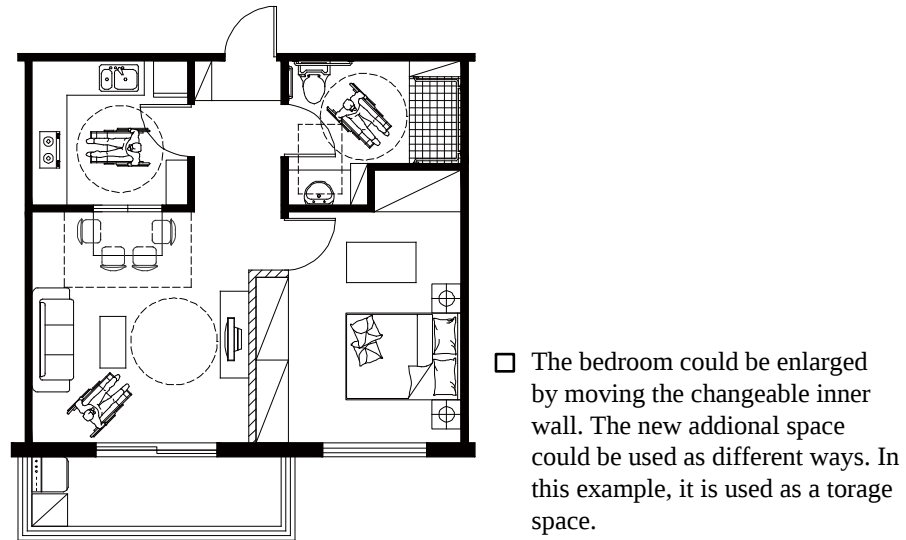


Figure 6-14 Bedroom remodel example of one bedroom type (ii)

In the second remodel example, the position of the inner wall is changed to enlarge the bedroom size. After the remodeling, there are more storage spaces in the bedroom. The remodeling is to satisfy the elderly, who like storing old things and are reluctant to throw them away. The additional space could surely be used in other ways.

6.6.2 Two-bedroom type

Generally, the basic considerations of the unit design of two bedroom type are same with them of the first one. There also are adjustable inner partitions in the unit which locate between the two bedrooms. Adjusting the bedroom size become possible thanks to the partitions. Another feature of the two bedroom model unit design is that the kitchen is semi-open. It makes the food serving more convenient and saves space in the living room. Figure 6-15 shows the model unit design with some important design tips.

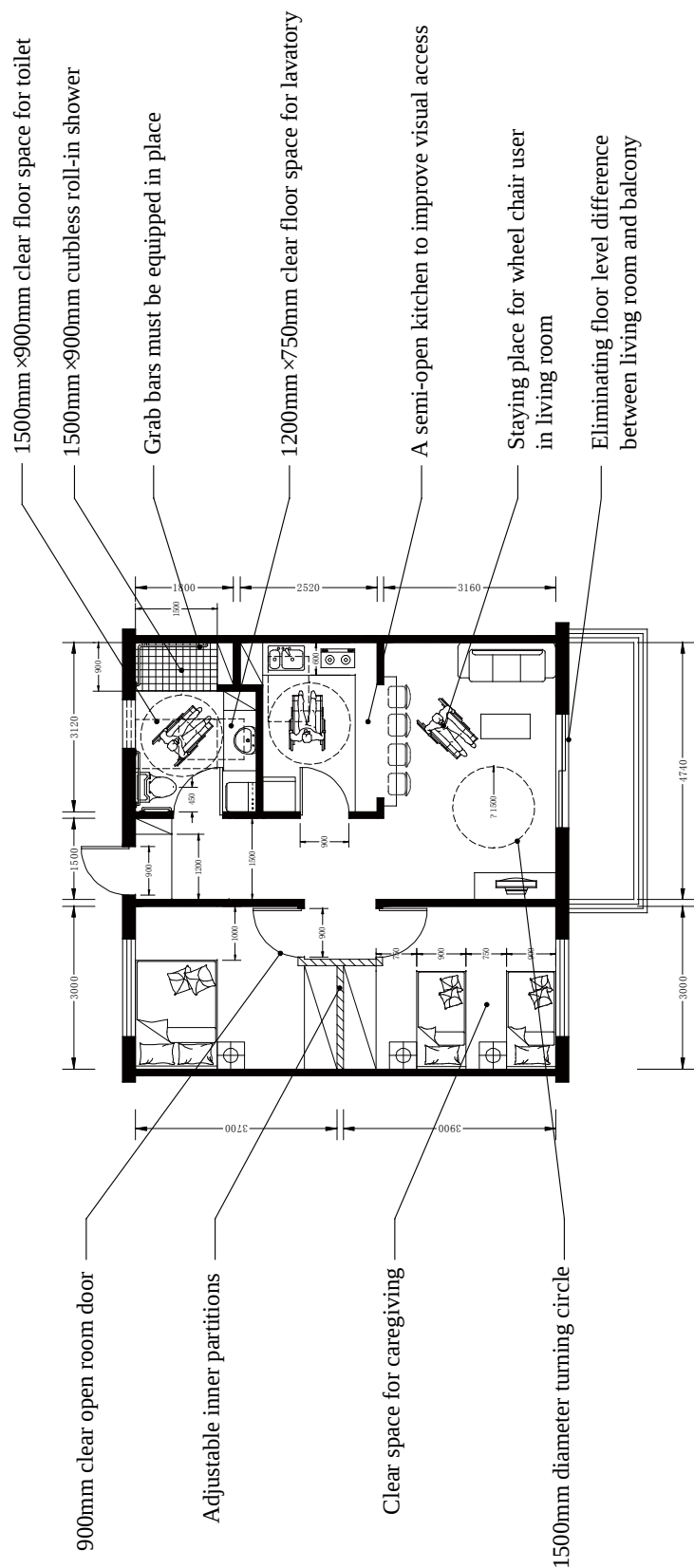


Figure 6-15 Model unit design of two-bedroom type unit

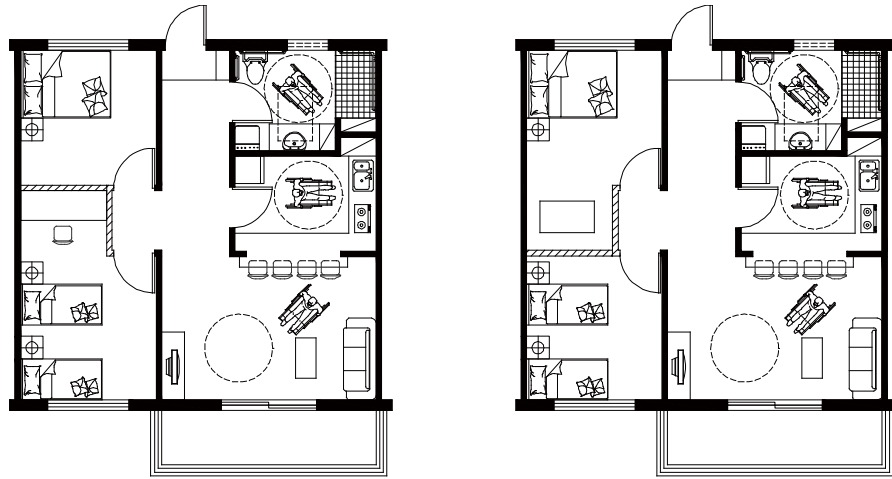


Figure 6-16 Remodel examples of two bedroom type model unit (i)

Similar with the one bedroom type model unit, the floor plan of the housing unit could be changed in the two bedroom type model unit. Through moving the partition wall, the sizes of two bedrooms could be changed (Figure 6-16). Residents could use the additional new space according to their needs. Figure 6-17 shows another possible remodeling. A new small room (1400mm × 2000mm) could be separated by moving the partition walls. This new room could be used in many ways. For instance, it could be used as a separate storage room or a study for the child.

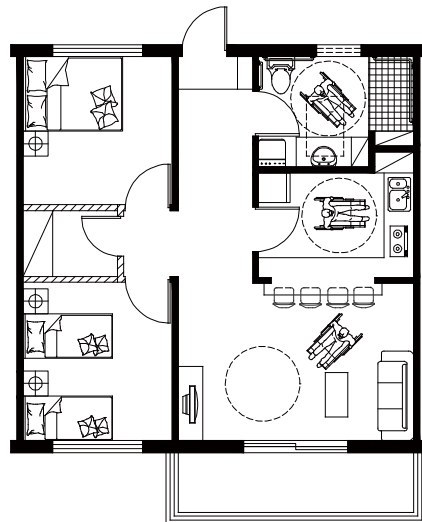


Figure 6-17 Remodel examples of two bedroom type model unit (ii)

6.7 Summary

In this chapter, the design guidelines for public housing in China are made based on UD concept. This guideline focus on the interiors, aims to improve the accessibility and usability of the interiors. The criteria for each interior room are established based on Chinese national codes on residential building design, UD concept, UD public housing design guideline in Hokkaido and the useful information conclusions of the preceding chapters. The case study about two surveyed housing unit give us a direct image about how the current interior of public housing unit is. And the model housing unit shows how it should be in the future. However, following the criteria in this chapter when doing public housing design doesn't mean we will utterly resolve the issues of accessibility in public housing unit. UD is an idealistic situation to a certain extent. Following the criteria just mean the building designers could provide basic accessibility and usability under a certain cost limit. More studies and practices are necessary to verify the validity of these criteria.

6.8 Reference

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7 Summary and Future Works

7.1 Summary of This Study

This chapter is a final conclusion of this study. Generally, this study explored the design guidelines for public housing design in China based on discussions on residents' satisfaction and their room usage. I also reviewed the housing reform and public housing system in China. Some problems of the system are pointed out. Meanwhile, public housing policies and system in Japan is mentioned as a case for comparison. It is also referable for China to overcome the shortcomings of the current public housing design and policy making.

Public housing policies and system in China

After the review on public housing policies and system, there are several shortcomings could be found. The shortage of provision is the primary problem. Although public housing has developed for more than a decade, the provision is still inadequate to meet the need of low-income people. The provision of both affordable housing and low-rent housing must be improved. Another problem is that the construction fund for public housing is extremely limited.

The developer, namely the government, has to consider how to save money in the process of construction. That leads to a low quality of living environment. Moreover, inequality exists in distribution of public housing unit, especially for affordable housing which is far cheaper than commodity housing. All these factors make the current housing policies questionable and imply that improvements are required.

Residents' satisfaction about housing unit features

The residents' satisfaction about housing unit features is firstly investigated in China and explored in this study. The information is of crucial importance for policy making and building design practice. The results indicate that living room, floor plan and housing unit size are the features which have high impact on their satisfaction and should be given more concerns accordingly. If we look at this issue taking the elderly and disabled as the main users, we found that they felt dissatisfied with their interiors, comparing to the data obtained from the first survey. That means we need to put more concerns on the actual needs of the elderly and disabled, since they might face more inconveniences in their life. In addition, the comparative analyses between common people and the elderly and disabled people indicate that if UD could be introduced into public housing design. Many current problems concerning accessibility and usability of the interiors would be overcome.

Housing unit typologies and residents' room usage

Totally, I obtained 365 housing unit plans from the two surveys. According to their room usage, all these unit plans were classified into different groups. Then, their common features are easily to be grasped. It is common that multiple generation families living in one bedroom unit. The two bedroom unit cannot satisfy some big families which have four or more family members. They all place an additional bed in the living room to resolve the problem. This implies that the living room has to serve more functions. Also,

many families remodeled the housing units based on different consideration. Most of remodeling is related to living room. A narrow living room usually is followed with a lower satisfaction. To a certain extent, it verifies in part that the living room is positively correlated with residents' general satisfaction with the unit features. The room usage of the elderly and disabled people mainly reflect their needs for a more accessible and usable housing interiors. The current public housing design basically is for common people with no disability. This perception of public housing design must be improved in the future.

Design guidelines for public housing in China

A major outcome of this study is the design guidelines for public housing in China. This guideline focuses on interiors, aims to introduce UD features into public housing based on the premise that the construction cost is controlled within a reasonable range. If the housing unit could meet the criteria of each room, the basic accessibility and usability could be provided. Meanwhile, two model unit designs, including a one-bedroom unit design and a two-bedroom unit design, are presented to clearly explain what a universal housing unit like. The design guideline is different with the national design code, in which the dimensions of each room and space are specifically regulated. It clarified several critical dimensions, such as the door open and turning space in each room, and presented some helpful strategies for architects.

Through this study, the basic issues concerning introducing UD into public housing design become clear. The guidelines are referable and helpful for getting rid of obstacles in living environment in the public housing in China. Improving the quality of living environment in public housing could avoid father home modification and expenses on it. It is not only meaningful for the residents, but also meaningful for energy saving on constructions in China. A larger scale of public housing and commercial housing

construction are predictable in China. If we could achieve a universal interior in housing, we could make a better living environment and it will benefit all people in China.

7.2 Future Works on Public Housing Design in China

This study is only a beginning of research on public housing design in China. Several shortcomings must be pointed out here as the future works we need to do.

(1) The housing unit plans used in this study are transformed from hand drawings. Thus, the accuracy of each housing unit plan is questionable. Although it is possible to conclude much useful information from it, the researchers must improve the accuracy of data to acquire more believable and accurate information concerning the housing unit plan.

(2) In this research, only the residents' satisfaction with unit features is explored. However, many factors might have impact on residential satisfaction, such as the distance to public facilities. How these factors correlate with residential satisfaction is a question worth to be considered in the future researches on satisfaction.

(3) The design guidelines in this research are only applicable to building and interior design. However, our residential environment includes many components. Only introducing UD in interior design is inadequate to create a universal society. More researchers in other fields should be involved in the UD research.

Research on UD is a relatively new topic for Chinese scholars. Few researches could be found concerning this topic. The current studies about UD in China are mainly composed of descriptive analyses about UD, which I have presented in the preceding section of this thesis. However, UD have been known by many of common people in countries like Japan. Hence, besides the future works I present above, one more work is to spread the UD concept

to common Chinese people. Building model housing unit and making it accessible for the public is a documented useful way to achieve that.

Appendix 1 Questionnaire for the Survey in 2011

Dear Residents of Public Housing in Shenyang City:

This questionnaire survey is organized by Northeastern University and Hokkaido University, in order to get useful information about the status quo of public housing in Shenyang City, and it will be the basic data for our research about public housing design. Please answer these questions according to your situation. If you have any question, please tell us, we will explain to you in detail. Thank you very much for your cooperation!

Architectural Department of Northeastern University/Architectural Department of Hokkaido University

K. Huo A.P./ T. Setoguchi Prof., Z. Li Doctor Student

2011.7.17

Part One. Basic Information about Your Family

1.1 The age of householder:

☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ Older than 70

1.2 The gender of householder: ☐ Male ☐ Female

1.3 Your family type:

☐ Single ☐ Couple ☐ Couple and children ☐ Single parent and children ☐ Couple, old people and children
☐ Other type_____

1.4 Your family size:_____.

1.5 How many old people (60 or older) in your family: _____.

1.6 The occupation of householder:

☐ Worker in state-owned enterprise ☐ Worker in private enterprise ☐ Worker in a public institution
☐ Freelancer ☐ Retirement ☐ College student ☐ No job

1.7 Which school the householder finally graduated from:

☐ Elementary school ☐ Junior high school ☐ Middle school ☐ University or college ☐ Vocational school
☐ No formal education

1.8 The per-capita monthly income of your family is:

☐ Less than 500 yuan ☐ 500-1000 yuan ☐ 1000-1500 yuan ☐ 1500-2000 yuan ☐ More than 2000 yuan

1.9 The health of you and your family: ☐ Good ☐ Normal ☐ Poor

Part Two. The Living Situation of Your Family

2.1 Which factor is most important for you when select a housing:

☐ Price and rent ☐ Location ☐ Area of housing ☐ Unit design ☐ Environment around the housing
☐ Some others_____

2.2 How long have you lived in present housing:_____Year

2.3 Do you want to keep living in present housing: ☐ Yes ☐ No

2.4 The area of your housing:

☐ Less than 40 m² ☐ 40-60 m² ☐ 60-80 m² ☐ 80-100 m² ☐ 100m² or more (Accurate area:_____m²)

2.5 How many bedroom in your housing:_____.

2.6 Which type of public housing you are living in:

☐ Low-rent housing, the rent is_____ ☐ Affordable housing, the price is_____ per square meters

2.7 Household appliances you have:

☐ TV ☐ Fridge ☐ Washing machine ☐ Electric fan ☐ Rice cooker ☐ Microwave ☐ Air-conditioner
☐ Water fountain machine ☐ Heater ☐ PC ☐ Some others_____

2.8 How often do you have guest in your housing or visit neighbors' home weekly:

☐ One times or never ☐ Two times ☐ Three times ☐ Four times ☐ Five times or more

Part Three. The Housing Satisfaction Level

Items	Evaluation				Reasons
	Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	
Housing Area					
Ventilation					
Sunlight					
Heating Supply					
Floor Plan					
Bedroom					
Living room					
Kitchen					
Bathroom					
Neighborhood relationship					
General idea					

(If you choose "Dissatisfied" or "Very Dissatisfied", please tell us the main reasons)

Part Four. The Sketch of Floor Plan

	Floor: North Arrow
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Thank you very much for your cooperation!

Appendix 2 Questionnaire for the Survey in 2012

Interview record

Interviewee name: _____ Date of interview: _____ No. _____

Introduction: This interview is jointly conducted by Northeastern University and Hokkaido University to collect information about how public housing residents evaluate their living environment. Your comments will give us the most meaningful information about how to improve the current public housing design according to universal design concept. Your personal information will never be revealed to any individuals or organizations. Thank you very much for your cooperation!

Your personal information	
Age: _____	Mobile: _____
Address: _____	E-mail: _____
Tel: _____	

Basic information about your family and your housing	
1. Age of the householder: _____ 2. Your family type: ☐ Single ☐ Couple only ☐ Couple with dependent child ☐ Single parent and child ☐ Couple, old people and children ☐ Others 3. The average capita monthly income of your family is around: ☐ Less than 500 Yuan ☐ 500-1500 Yuan ☐ 1500-2500 Yuan ☐ More than 2500 4. Is there anyone with mobility impairment in your family: ☐ Yes _____ (Age: _____) ☐ No 5. Is there elderly people in your family (60 or older): ☐ Yes _____ (Age: _____) ☐ No 6. Is there child in your family: ☐ Yes _____ ☐ No 7. The length of your residence: _____ 8. The health status of your family members: ☐ Good ☐ Normal ☐ Bad 9. The area of your housing: _____ 10. The dwelling unit type: _____ 11. You are living in: ☐ Affordable housing _____ ☐ Low-rent housing _____	Notes:

The evaluations on different space:		
Items	Evaluations	Comments Space Dimension; Floor; Entrance door; Accessory facilities
The entrance	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Living room (Dining space)	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Bedroom(s)	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Kitchen	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Lavatory	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Balcony	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Storage space	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Corridor	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Stair well	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	
Approach to the building	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied ☐ Very Dissatisfied	

Sketch of the Floor Plan

Notes:

Appendix 3 Interview Record with Public Housing Designers

Interview 1: Public Rental Housing Project: Huimin Xincheng

Date: 27/8/2013

Place: Shenyang Architecture Design Institute

Participator: Zhubin Li, Tiantian Song.

(Translated from the original Chinese record)

Li: Today, I want to ask for some information about the *Huimin Xincheng*. I know it is a new public rental housing project in Shenyang city. Could you firstly introduce the general background of this project?

Song: First, I must say that if you want to know the information about the housing unit design, maybe, I cannot help you so much. Because, I am a site planner, not an architect.

Li: Is the building designed by this institute?

Song: No. The building design was jointly completed by the several big design institutes in Shenyang according to the requirement of local government. They referred to a study on public rental housing design conducted by an institute in Beijing, then finished the design and gave it to us. What we did were some amendments.

Li: That is to say that you just amend the housing unit design a little and made a site plan for this project. Am I right?

Song: Yes. So I know much about the site plan. But about the building design, I don't know so much.

Li: OK. You can introduce what you know to me. Do you have a basic concept for this project? I mean a basic consideration about how to do the design.

Song: I think we don't have any concept for this project.

Li: You mean it is generally same with the other residential building design. Right?

Song: Yes. It is same with other rental housing design. However, you must control the housing unit size not exceed a certain limit.

Li: Could you tell me more about the size limit? I know the housing size limit for low-rent housing and affordable housing. They are 50m² and 70m², respectively.

Song: In this project, the housing unit size limit is 70m². Namely, the maximum housing unit is 70m². There are eight housing units on one floor.

Li: That is to say that the building design in this project basically has no difference with common residential building design. Because that my research might focus on the elderly and disabled more. Did you pay any special concerns on these people? Or you just do the design as same as others, just take the unit size limit into consideration.

Song: Yes, you are right.

Li: This is the floor plan for one floor, right? There are three different unit plans. How many bedrooms are there in one housing unit?

Song: The utmost is two. The units on the side of the basic floor plan have two bedrooms.

Li: This project have been finished or not.

Song: It had been finished. I don't know if it has begun to be rented, but it must have been finished.

Li: How about the location of the project site?

Song: It located at a site between the third ring road and the fourth ring road of Shenyang.

Li: How about the surroundings of the project site? Is it farmland?

Song: You mean the surrounding of this project?

Li: Yes.

Song: Yes. Basically, just farmland could be found. Some small villages could be seen originally. They might be relocated.

Li: Are there any city amenities around the project? Such as, bus stop or supermarket.

Song: No, there aren't. It is very desolate.

Li: How many units this project could provide? And who decide the rent?

Song: About 2034 housing units could be provided in this project. I don't know anything about the rent.

Li: Are there any guidelines for public rental housing design in Shenyang city? Or a recommended housing unit design. I remember cities like Beijing and Shanghai have their own design guidelines for low-rent housing and affordable housing.

Song: No. No guidelines in Shenyang city. We did the design and plan based on the guidelines of Beijing. We referred to it and amended some of items to make it applicable to Shenyang. I heard that the guidelines for public rental housing design are being made by China northeast architectural design and research

institute. The guidelines in Beijing are for public rental housing. Here are some specifications about the plan, building area and housing unit number.

Li: Originally, I want to ask some questions about the architectural design.

Song: If so, I cannot help you father.

Li: I know some residents will be involved in the process of building design and site plan in some countries. According to your experience, how about China?

Song: Maybe, we don't have similar system.

Li: Personally, I think the government will decide the public housing unit provision and project site, what a design institute has to do is following the requirements of the government and meeting the national design codes. What do you think about this opinion?

Song: I agree with you. Resident involvement is not so popular in China.

Li: Could you provide some pictures about the project for me? Then, I can know more about the project, like the site plan and housing unit design.

Song: No problem.

Li: Thank you very much for your cooperation.

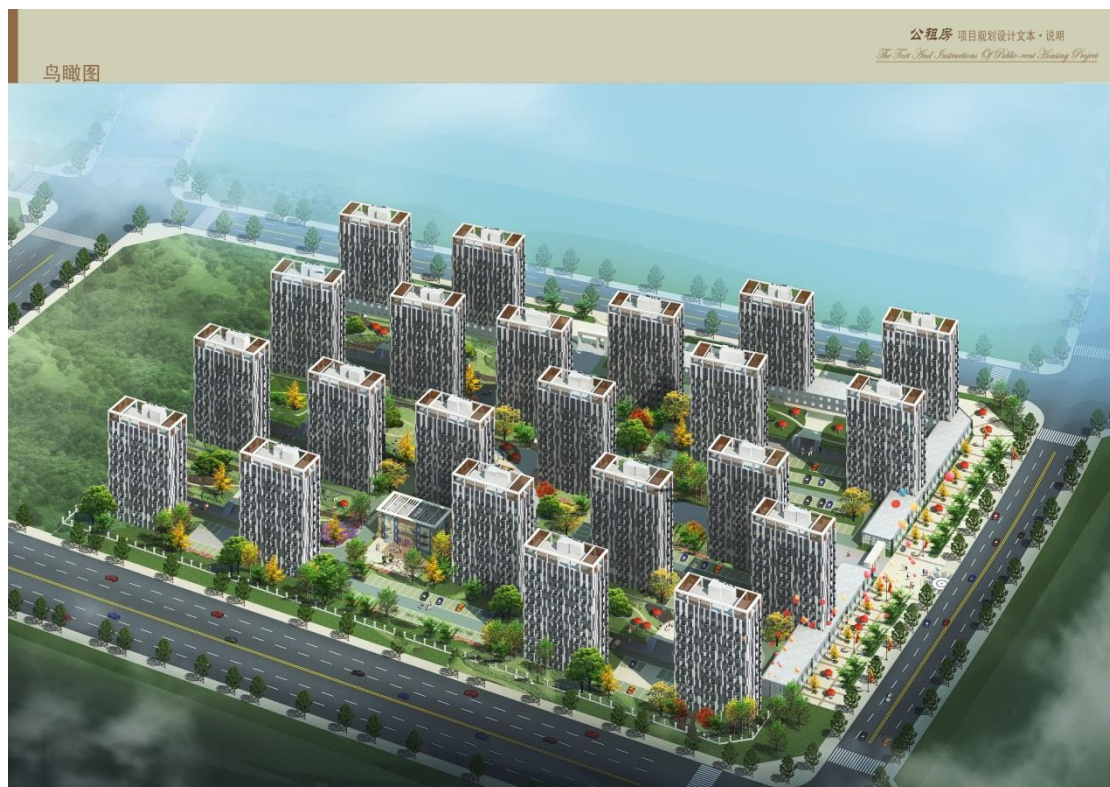


Figure 1 Aerial view of the project

户型平面图

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Interview 2: Public Rental Housing Project: Fenghuang Xincheng

Date: 9/9/2013

Place: China northeast architectural design and research institute

Participator: Zhubin Li, Peng Cao.

(Translated from the original Chinese record)

Li: Thank you very much for accepting my interview. I want to know something about the housing unit design.

Cao: Concerning public housing design, it just needs to meet the most basic requirements of residents. The standard of design is low.

Li: I think the public housing construction is directed by the government generally. Such as the specifications for each project and the general public housing provision are decided by the government.

Cao: Public housing construction, including public rental housing, is guided by the government. There is no public housing project developed by private real estate developer.

Li: That is to say that the building design commission comes from the government. They made requirements for the project and then you need to make design accordingly.

Cao: In fact, the developer of this project is a company run by the government.

Li: About the residents, you know, there are many projects abroad that the residents can be involved in the process of building design. In this project, have any residents been involved?

Cao: No. It is seldom seen in China.

Li: Maybe, it is very difficult in China.

Cao: Yes. Impossible and not realistic.

Li: Are there any guidelines for public housing design available in Shenyang city?

Cao: I haven't seen any guidelines about that.

Li: Did you refer to any guidelines for housing design in other cities?

Cao: When we did the building design of this project, we referred to some projects in Beijing. They have completed many public housing projects. For example, the floor plan of this project is generally same with it of a public housing project in Beijing. That is because the floor plan of that project has been accepted by market and government leaders.

Li: Using the floor plan of that project directly in this project with few modifications.
Am I right?

Cao: Yes.

Li: Could you tell me some characteristics of this project?

Cao: First is the design standard of this project is low as a residential building. It can just meet the most basic requirements for residential building.

Li: Is it designed according to the minimum of national codes?

Cao: Yes, that is basically right. The density is high. There are four housing units on one floor. A common density is one floor three housing units. But in this project, it has four housing units. Moreover, the housing unit size is limited. Generally, the housing unit size is around 70m². Some unit might be smaller than 70m².

Li: Do all housing units have two bedrooms?

Cao: Some of them have two bedrooms. However, one bedroom type also could be found in this project.

Li: So, the basic concept is providing more housing units based on the premise of saving city land. And the design standards are low.

Cao: Yes, you are right. The design standards are very low. About the barrier-free design you just mentioned, we don't have any considerations about that. Since barrier-free design implies a high design standard. It has some specific requirements on the width of corridor and hallway in each housing unit. You must ensure that a turning space is available for a wheelchair. This could not be satisfied in this project.

Li: That means the architects haven't realized the importance of it.

Cao: No. We all know it. But, the design standards set by developers are lower than other residential building design. Nowadays, the reality is that most of developers don't take barrier-free design into account. Although the state do have regulations on it. For example, in one project, the developer must provide some barrier-free housing units. But, in fact, most projects ignore the regulations and the building design is similar with this project.

Li: One year ago, I interviewed a manager of Shenyang real estate bureau. He told me that they were formulating a regulation on public rental housing decoration. Have the regulation been issued? Do you have the final version of the regulation?

Cao: I don't know it. The interior design of this project was made by another

company. And the interior design standard is decided by the government. They made the standard based on construction scale and cost. The standard is revised at times according to the new situation. So it doesn't have a specific standard. For example, in this project, all housing units only are decorated basically. Only if the housing units are decorated elaborately could the cost and design standard are fixed. The basic decoration is provided in this project, but we didn't participate in the interior design. The government employed an interior design company. They have to consider it as a whole, the developer kept contact with us in the process of design. For example, they had thought of using modular bathroom. They thought it could be equipped fast and therefore saving time. However, they set a limit for the construction cost. If they do so, the cost will exceed the limit they set. So they gave up finally. Therefore, in the process of design and construction, the standard of decoration is adjustable. At least, I don't know if there are universal regulations for housing unit decoration in this project.

Li: So the construction cost has great influence on design.

Cao: Very great. It is unrealistic that building public rental housing luxuriously. The target people of public rental housing are those low-income. They are considered people from the low social stratum.

Li: You also made the site plan for this project?

Cao: Yes. The building design and site plan were completed by us. Concerning interior design, they employed another company. It is not a professional interior design company, because it is unnecessary. They employed construction corps who can also do the interior design. Unlike the commercial housing unit decoration, we might pursue a better image and appearance; they only need the most basic decoration, something like plastering the rough wall and equipping toilet.

Li: When would this project be completed?

Cao: Most of it has been finished. They are decorating the interiors now.

Li: I know some other public rental housing projects in Shenyang city, such as *Ditie Xincheng*. Could you introduce more public rental housing projects to me?

Cao: There are several projects are being constructed, such as *Lishui Xincheng*. We are making the building design now. But the first stage of this project was not designed by us. We are doing design for the second and third stage of the project.

Some other project, like *Huimin*, is designed by Shenyang architecture design institute. Another one I know is called *Binhe*, designed by an institute in Beijing.

Li: All of these projects are newly built, right? I heard from a manager of Shenyang real estate bureau that some of public rental housing units will be transformed from commercial housing unit bought by the government.

Cao: I don't know about that. According to what I know, these projects are still under construction. How can they be transformed to commercial housing?

Li: Maybe, the government has its own consideration. Such as to save time, they could directly buy commercial housing unit from the market and transform them into affordable housing or any other public housing unit.

Cao: I don't know too much about these. They are things about the housing policies. For example, to enter market quicker, they might buy a few commercial housing units.

Li: Yes. Like *Changbai Xincheng*.

Cao: But I think the cost of doing that may be higher. Because the projects I know almost locate at relatively remote places from downtown. That is a reason why call public housing design as design with low quality.

Li: Could you provide me with a few pictures about the project?

Cao: Sure. I can give to you later.

Li: Thank you very much for your cooperation! That's all.



Figure 4 Site plan of Fenghuang Xincheng



Figure 5 Image of the project after completion



Figure 6 Floor plan of one building

Acknowledgements

The thesis could not have been completed without the supports and advices from many people. It is my great pleasure to acknowledge those people here who have contributed to my doctoral thesis.

First, I would like to express my deepest gratitude to my supervisor Prof. Setoguchi for his constructive advice about how to do study. I still remember his explanation about the Japanese words “二番煎じ(nibansenji)”. He told me that we must do the studies which are creative and innovative. Doing studies which have been done by other researchers is just like repeatedly infusing tea. The tea will become tasteless. Similarly, the studies will become uninteresting and unattractive. That has been my motto in my academic life.

I am grateful to Prof. Koshizawa, Prof. Okada and Prof. Mori, who gave me valuable advice about my thesis and future studies. I am indebted to Prof. Huo from Northeastern University of China (NEU), who is my supervisor previously. For it is impossible to finish the surveys at Shenyang city without his support. Thanks are also given to the students from NEU for their careful work in the surveys. I also want to express my gratitude to my senior, Xiangwang Meng, for his suggestion on my study and my friend, KUARE Coggan Donald, for his kindly help with the journal paper writing.

Thanks go also to China Scholarship Council (CSC), who provides financial support for my study in Hokkaido University.

Finally, I would like to express my sincere appreciation to my parents and my wife. Without their love, support and encouragement, I would not have been able to through the hard time of this program and finish the thesis.